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INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY'.)

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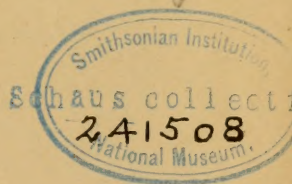
WILLIAM CARRUTHERS, Ph.D., F.R.S., F.L.S., F.G.S.,

ARTHUR E. SHIPLEY, M.A., Sc.D., F.R.S., F.Z.S.,

AND

WILLIAM FRANCIS, F.L.S.

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VOL. XV.—EIGHTH SERIES.  
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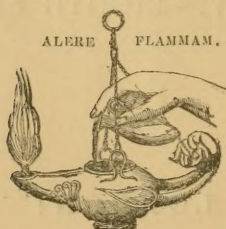
1915.

"Omnes res creatæ sunt divinæ sapientiæ et potentia testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportionone, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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ERRATA.

Page 56, after line 1, the description refers to *Macrochæta clavicornis*.

58, in the description of Plate III., fig. 5 refers to *Prægeria*, the rest of the figs. (6-9) refer to *Macrochæta clavicornis*.

134, line 26, for *Eur.* read *Em.*

136, line 22, for *Myrmosphyma* read *Myrmophyma*.

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THE ANNALS

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MAGAZINE OF NATURAL HISTORY.

[EIGHTH SERIES.]

"..... per litora spargite muscum,
 Naiades, et circum vitreos considite fontes:
 Pollice virgineo teneros hic carpite flores:
 Floribus et pictum, divæ, replete canistrum.
 At vos, o Nymphæ Craterides, ite sub undas;
 Ite, recurvato variata corallia trunco
 Vellite muscosis e rupibus, et mihi conchas
 Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasi, Ecl. 1.

No. 85. JANUARY 1915.

I.—*Notes from the Gatty Marine Laboratory, St. Andrews.*
 —No. XXXVII. By Prof. M'INTOSH, M.D., LL.D.,
 F.R.S., &c.

[Plates I.—III.]

1. Additions to and Remarks on the British *Spionidæ* and *Cirratulidæ*, viz. on *Spio martinensis*, Mesnil, *Nerinides longirostris*, De Quatrefages, *N. tridentata*, Southern, *Polydora cæca*, Ærsted, *Aonides paucibranchiata*, Southern, *Chætozone alata*, Southern, *C. killariensis*, Southern, and *Macrochaeta clavicornis*, Sars.
2. On the British *Terebellidæ*.
3. On the *Terebellidæ* dredged by H.M.S. 'Porcupine' in 1869 and 1870, and by the 'Knight Errant' in 1882.
4. On the *Chætopteridæ*, *Amphictenidæ*, and *Ampharetidæ* dredged in the Gulf of St. Lawrence, Canada, by Dr. Whiteaves in 1871-73.
5. On the *Ampharetidæ* and *Terebellidæ* dredged by Canon A. M. Norman off Norway.
6. On the Occurrence of one of the *Pisionidæ* at St. Andrews.

1. *Additions to and Remarks on the British Spionidæ and Cirratulidæ.*

THE careful researches of Mr. Southern, especially on the West Coast of Ireland, a region so rich in rarities, has resulted in several additions to the above families, as well as to others. Thus *Spio martinensis*, Mesnil, has been

Ann. & Mag. N. Hist. Ser. 8. Vol. xv. 1

procured on both shores of Ireland, a form in which the head has a rounded median lobe projecting in front, supported by two lateral (peristomial) lobes. Two or four eyes occur at the posterior border, a short median tentacle on the prostomium, and a median ridge ends posteriorly in a short process. The body is like that of a typical *Spio*, is about 3 cm. long and 1-2 mm. broad, with 85 to 90 segments (Mesnil), ending in a dorsal anus with four foliaceous cirri. The colour is of a salmon-tint, with red lines from the blood-vessels, and dark brown pigment in transverse rows on the segments. The first foot bears a ventral tuft of finely tapered bristles with very narrow wings, and a large branchia which overlaps that of the opposite side. At the tenth foot (Pl. I. fig. 6) the ventral lamella is elongated vertically, its upper margin being deepest, and separated by a narrow cleft from the dorsal lamella, which fuses with the edge of the branchia. The bristles are typical. Winged hooks appear on the eleventh foot, and they have a bold curve at the junction of shaft and neck, then diminish upward to the main fang, which is long, sharp, and comes off at more than a right angle with the neck. A single spike occurs on the crown above it.

In the thirty-first "Notes" in the 'Annals'* for February 1909, some remarks were made on "a form apparently falling under the *Nerinides* of Mesnil," from the 'Porcupine' Expedition of 1870, and which had long been named *Scolecolepis*, H. This form, as Mr. Southern† truly says, is not a *Nerinides*, and differs from two species of *Nerinides* which he has been fortunate in securing on the West Coast of Ireland, viz. *Nerinides longirostris*, De Quatrefages‡, as more clearly described by De St. Joseph§, and *Nerinides tridentata*, Southern. The former, which reaches 10 cm. in length and 8 mm. in breadth, at first sight mimics *Nerine foliosa*, Sars, yet differs in having a branchia on the first segment besides a dorsal and a ventral setigerous process with bristles. The head is acutely pointed and has a median ridge or keel, running back to the third segment, with four eyes in a square; whilst the peristomial segment bears a pair of short golden-yellow tentacles, each with a ciliated groove. Hooks with a single spike above the main fang appear in the ventral division between the thirty-third or forty-fifth segment, and are accompanied by a few wingless bristles.

* Ser. 8, vol. iii. p. 175.

† Proc. R. Irish Acad. vol. xxxi. no. 47, p. 97. I am indebted to Mr. Southern for kindly forwarding examples of his new and rare forms.

‡ Annel. i. p. 444, and previously in 1843 (Mag. Zool.).

§ Ann. Sc. nat. 7^e sér. t. xvii. p. 74, pl. iv. figs. 86-90.

The feebly winged bristles persist in the dorsal division to the posterior end, but no hooks accompany them. In the last twelve or thirteen segments the branchiæ diminish and disappear. The second species, *N. tridentata*, is smaller (1 inch), with two pairs of eyes arranged nearly in a transverse line on the spindle-shaped head, and a pair of short, thick, deep chocolate tentacles. The first setigerous segment carries only a ventral tuft of capillary bristles, and thus differs from the foregoing with a branchia on the first foot, as it also does in the presence of winged hooks with two spikes above the main fang on the fifteenth segment ventrally. Branchiæ commence on the second foot. Mr. Southern observes that this species frequents laminarian roots, whereas *N. longirostris* is found in clean sand.

Another form, *Polydora cæca*, Cæsted, which some have confounded with *Polydora flava*, has been procured from diverse localities on English, Scottish, and Irish shores. In general aspect it resembles *P. flava*, but is distinguished by the presence of stout acicular bristles in the dorsal division of the foot from the twenty-fifth segment in front of the anal "sucker" backward. The strong bristles of the fifth segment resemble those of *P. flava*, with a bold hook at the tip and no spur.

Mr. Southern records *Polydora giardi*, Mesnil, a form with a spur below the terminal hook of the great bristles of the fifth segment. The examination of a minute example has not proved the necessity for including it as yet as a separate species.

Aonides paucibranchiata, Southern, a small form from the West Coast of Ireland, differs from the common *Aonides oxycephala*, Sars, in having only ten or eleven pairs of branchiæ instead of 22-23 pairs. The tail has four cirri, whereas in *A. oxycephala* the caudal region has dorsally two short conical lobes, and ventrally eight smaller conical cirri. As the result of Mr. Southern's special attention to the Cirratulidæ in the rich region of the West Coast of Ireland, two new species of *Chætozone* have been found, viz. *C. alata* and *C. killariensis*, both very small species; yet both were found mature. The former has a conical head and a pair of deeply-placed eyes. The tentacles are large, and each is accompanied by a lateral cirrus. Capillary bristles occur in all the dorsal tufts, the shorter forms with flattened tips. Hooks appear ventrally in the twenty-first segment, and capillary bristles are always present in the ventral division. The conical head of *Chætozone killariensis* is devoid of eyes, and the tentacles and their lateral cirri are present in front of the first bristled segment. Anus dorsal, with a ventral

lobe beneath. In the anterior and middle regions of the body both dorsal and ventral divisions of the foot have only capillary bristles. Hooks appear ventrally on the fifty-sixth segment and dorsally on the sixty-first (Southern). The dorsal hooks resemble flattened bristles with hooked tips.

2. *On the British Terebellidæ.*

In Dr. Johnston's 'Catalogue of Non-Parasitical Worms in the British Museum,' twelve species of Terebellids are entered, but four of these refer only to two species, viz. *Terebella littoralis* and *Terebella conchilega* to the common *Lanice conchilega*, and *T. nebulosa* and *T. tuberculata* to *T. nebulosa*, Mont. On the other hand, it is possible that his *Terebella constrictor* includes two species. In addition to the forms mentioned, Dr. Johnston's list comprised *Amphitrite cirrata*, *Amphitrite johnstoni*, *Nicolea venustula*, *Lepræa textrix*, *N. maculata*, *Thelepus cincinnatus*, and *Terebellides stræmi*.

In his well-known 'Annulata Polychæta' of Spitzbergen, Greenland, Iceland, and Scandinavia, Malmgren in 1867 recorded thirty-one species; but several are synonymous, so that there were really about twenty-eight—not, after all, a great number from an area so extensive, and one that had been so frequently searched by skilful zoologists.

The rich and comparatively unexplored region of the west of Ireland, so far as regards Polychæts, has lately produced, by the broad views of the Irish Fisheries' Department and in Mr. Southern's skilful and energetic hands, no less than twenty species of Terebellids, or double the number entered in the 'Catalogue of the British Museum.' Several of these are additions to the British Fauna, and will be dealt with on a future occasion.

In the present preliminary notice of this important family from British waters, the number approaches that of Malmgren from the more extended northern area, and it is probable that future researches will make additions to the list; indeed, several forms are at present under consideration.

The first British species is *Amphitrite cirrata*, O. F. Müller, which ranges from Devon to Shetland. The cephalic plate is comparatively adherent, for the dorsal collar is limited, and the edge externally bends over into that of the supra-oral fold, the whole plate being more limited than usual. A sub-oral fold occurs within, and externally is the lower lip on

the ventral border—the dorso-lateral continuation of the lip bearing the first group of branchiæ. The tentacles have the normal structure and a deep groove. The segment following the foregoing has no distinct shield, the anterior edge ventrally forming a free border and ending laterally on each side in a rounded free flap. A second free anterior rim follows, also ending laterally in a rounded flap, opposite the second branchia. In the middle line is a large shield, which sometimes indents the segment behind it. Opposite the third branchia and the first bristle-tuft is a third rounded external flap, which passes further dorsalward than the other two. It abuts on a narrower shield than the one in front.

The body is enlarged anteriorly and gradually tapered posteriorly to the terminal anus. Dorsally it is rounded, ventrally are about ten to twelve shields anteriorly, and then a median groove passes to the posterior end. Seventeen pairs of vertical flattened setigerous processes occur anteriorly, the first being in a line with the last branchial tuft. The bristles are dull golden and in two series—a longer and shorter; the former are deeply inserted, have shafts nearly of uniform diameter throughout, and have comparatively short tapering tips with wings which are broad at the commencement, but taper off distally. The condition of the tip, however, is variable, apparently from injury, since many are short with short and broad wings and tips that taper little, the result, in all probability, of injury and repair. The shorter series has winged and tapering tips, though a few at the edge present short (broken?) tips with broad wings. A minute papilla occurs on the ventral side of the setigerous process, from the second to the eighth bristled segment. Moreover, just below the papilla a little flap is developed at the dorsal end of each hook-row, and sloping backward behind it from the first bristled segment (which has no hooks) to the last, where, however, it is less distinct. No hooks occur opposite the first bristle-bundle; a single row is present on the next foot, and for several feet thereafter, but the eighth has two rows. The hooks have in lateral view about four teeth above the main fang, and the posterior outline curves forward to the crown and has a projecting process of the base inferiorly. The base has a gentle curve, slopes from behind downward and forward, and an eminence occurs on the anterior curve below the main fang. Striæ pass from the teeth on the crown to the posterior border of the neck. The broad ridges for the hooks are large in the bristled region, but thereafter they diminish to short lamellæ, and then to low ridges toward the tail. The

posterior hooks have smaller (shorter) bases, and the posterior outline is less curved toward the crown.

The second species is *Amphitrite figulus*, Dalyell*, not uncommon in British waters as well as in more northern seas. Its cephalic region differs from that of *A. cirrata* in the great development of the fold in front of the tentacles, which forms an arch over the mouth. At its outer edge, on each side, it bends backward to become continuous with the broad dark brownish fold behind the tentacles, which, however, in this form is limited in extent, for the median portion is narrow. This structure of the posterior fold is characteristic. The mass of grooved and frilled tentacles springs from the hollow between these arches, and forms a centre of very active functions during the life of the animal, their colour then being pale orange or pink. The projecting dorsal portion of the arch or lip is dark brown inferiorly. Many cells and granules occur in their interior. Below the dorsal arch is the mouth, and beneath is a globular process followed by the lower lip, which is separated by a groove on each side from the folds or arches. Behind the lower lip ventrally is a well-marked collar with a crenated anterior border stretching completely across the ventral surface in the line of the first branchia. It has a rounded free edge dorso-laterally, and a median and two smaller crenations at its posterior border; and these probably usher in the change seen in the next ring, which has a distinct, though small, median scute or pad.

The body is 6-8 inches in length, enlarged in front and tapering toward the posterior end, as usual in the family. The segments number from ninety to a hundred, and of these twenty-four bear bristles—the first being opposite the third or last pair of branchiæ. The dorsum anteriorly is, in the preparations, tessellated somewhat as in *Scalibregma*, each of the two rings in the segments being crossed antero-posteriorly by folds which cut the ring into narrow spaces. On the ventral side of the second branchia is a papilla, the forerunner of the setigerous process which follows in the next segment. Moreover, below each setigerous process is a small papilla, as in *A. cirrata*, but these continue over sixteen segments instead of the few in *A. cirrata*. The bristle-tuft is situated at the posterior part of one ring, whilst the following ring lies between the bristle-tufts. This arrangement, however, extends only over thirteen or fourteen rings, viz. from the interval between the second and third

* *A. brunnea* of Stimpson?

branchiæ backward. Then the rings are marked by transverse furrows, each being thus divided into two, whilst further backward, as the space between the bristles increases, into a larger number of rings. In some cases the posterior lamellæ for the hooks are asymmetrical, an intermediate lamella occurring on one side only. The posterior segments show less regularity in their narrow transverse dorsal furrows. Posteriorly the body diminishes and ends in a terminal anus.

Behind the first distinct scute or ventral shield already mentioned in connection with the mouth is a narrow elongated one, followed by thirteen others, those immediately succeeding the very narrow one gradually though slightly increasing in antero-posterior diameter to the eleventh or twelfth, whilst the last three or four are rudimentary, being rounded or shield-shaped median elevations, gradually disappearing to end in a moniliform and somewhat elevated median ventral ridge, which by-and-by is lost in the groove posteriorly.

The branchiæ are three in number, of a fine dark red colour, and slightly mottled under a lens. They coil and twist actively under examination. The first is the largest, the third the smallest. Each springs from a cylindrical base, which soon divides dichotomously, though occasionally a small tuft of three short filaments may be found on the main stem of the first branchia. The terminal branches are long and tapering, and in life these give the aspect of gills formed of simple filaments. Each filament is enveloped in a transparent structureless cuticle, whilst the centre is marked by coherent granular tissue arranged in a close series of transverse rows, so as to give the whole a finely barred aspect. No distinct longitudinal fibres are apparent, though in some a longitudinal canal is seen. In the basal region are many large compound bodies, the "blood-globules" of Williams.

A small conical papilla situated in the groove close to the exterior of the second pair of branchiæ marks the commencement of the setigerous processes, though it has no bristles, and it is in a line with the second post-oral fold—in the centre of which is the first small shield or scute. The first bristle-tuft is opposite the last branchia, only a short interval separating it from the base of the organ. It springs from a setigerous papilla at the dorsal edge of the ridge for the hooks. The bristles form a vertical row of considerable depth, and in structure agree with the succeeding tufts, no rudimentary forms marking the commencement of the

series, as in various groups. Each tuft consists of a longer series with stout, straight, and long shafts, the free portion of which is slightly diminished in diameter toward the commencement of the winged tip, which is finely tapered and curved. The tips of the bristles are directed upward and backward in their normal condition. The shorter series consists of those with shorter and less tapered winged tips which have an accessory terminal blade carried at an angle to that beneath, and is broad at the base and tapered to a slender, slightly curved tip. Such a bristle approaches that of certain Sigalionidæ, such as *Sthenelais jeffreysii*. The structure of these bristles remains the same from the first tuft to the last, but the setigerous processes increase in prominence in their progress backward.

No hooks or their homologues occur in the ridge running downward from the first bristle-tuft, and the ridge itself is intermediate in character. The ridge from the second pair of bristles presents a lateral border and a median linear elevation containing the single row of hooks, the ridge terminating ventrally in a rounded border at some distance from the ventral shield, the ridges which follow gradually approaching the ventral scutes or shields until, at the eighth, they touch. The third ridge has a double row of hooks, but they appear to be less regular than those which follow. As a rule, the ridges for the hooks are longest in front, and diminish a little toward the twenty-fourth bristle-bundle. Each leaves the setigerous process as a slightly flattened ridge with an anterior, a median, and a posterior fillet, the median bearing the rows of hooks. On the cessation of the bristles the thick and rather long ridge for the hooks increases in prominence and presents a free edge dorsally and ventrally. It diminishes in depth while increasing in prominence posteriorly. The rows of hooks in life are terminated ventrally by a brownish speck. In the posterior processes the hooks are in a single row.

The hooks, which commence at the second bristle-tuft and continue to the posterior end, differ from those of *A. cirrata* in the less oblique base, and in the curves of the anterior outline below the great fang. Usually four teeth occur in lateral view on the crown above the fang, but when examined in front the crown appears to have several transverse rows.

The next and third form resembles very closely *Amphitrite groenlandica*, Malmgren, and is found both on the British and Canadian shores. The branchiæ are slightly branched, and arise by a short stem, which breaks up into a number of

simple branches. The hooks approach those of *A. cirrata*, but have different curves, with two teeth above the main fang.

Another British species, *Amphitrite affinis*, Malmgren, the fourth form, has been found on various parts of the coast, and will be alluded to more particularly under the forms dredged by the 'Porcupine.'

Amphitrite gracilis, Grube (*Physelia scylla* (Sav.), De Quatrefages), the fifth form, is chiefly a southern type which also extends to Ireland. The dorsal cephalic collar forms a small crenated rim posteriorly, and passes downward at each side to join the lower edge of the supra-oral arch. The tentacles which take origin from it are numerous and have the typical grooved structure. They are of a pale cream-colour and partly translucent. Its front edge terminates in a prominent spout-shaped arch over the mouth, the sides inferiorly sloping obliquely to their attachment. The lower lip is formed by a transverse fold, and within it is a small tongue-like fold or eminence. No eyes are visible in the preparation behind the cephalic collar.

The body has a hundred and twenty to a hundred and forty-six segments, and is characterized by its great proportional length, and slenderness posteriorly, as well as by its pale cream-colour here and there enlivened by the blood-vessels and the brownish-red specks posteriorly. The enlarged anterior end has further a close series of transverse ridges, which have a minutely tessellated appearance from isolated glandular masses arranged transversely. These glands have, besides the granules, clear refracting cells and globules. The separation of the longitudinal dorsal muscular fibres in this region also increases the tessellated aspect. Behind the bristled region the body gradually narrows and ends in a slender tail with a terminal anus surrounded by marginal papillæ. The dorsal surface is convex, the ventral flattened anteriorly and grooved posteriorly. The glandular shields or plates in front are about twelve in number, with a few (three or four) additional small median processes. Behind the region of the shields is a median groove with a prominent ridge on each side. At first lateral, these ridges gradually pass to the mid-ventral line, forming posteriorly a raised belt with a median fissure, then widen a little toward the tail, where the papillæ for the hooks occur in the line of each moniliform ridge, and gradually diminish as the tip is reached. Whilst the segments in front have

several narrow rings dorsally—giving a finely ribbed aspect to the surface,—the narrow posterior region has only the segment-junction separating each smooth segment.

Behind the lower lip is apparently a segment with a narrow ventral shield. The next bears the first and larger pair of branchiæ, each springing from a short stalk which rapidly gives off four main divisions; these split up after a brief course into a sub-dichotomously divided tuft with comparatively short terminal branches—the whole forming a dense arbuscle. The second and smaller pair is on the next segment and has a similar structure. Occasionally a specimen has three branchiæ on one side and two on the other, the third being a small independent stem behind the second.

Ventralward of the second branchial stalk is a small conical papilla which represents the first setigerous process, though it has no bristles. The next setigerous process has a well-developed tuft of bristles, which are pale, translucent, rather brittle, and in two groups; the longer forms have long, straight, deeply inserted shafts, which are nearly cylindrical to the commencement of the wings, from which they taper to a delicate point. The wings have a characteristic expansion at the base, and are narrow distally and show no serrations. The shorter bristles have peculiarly curved, tapering, serrated tips without distinct rings. Whilst the two setigerous processes behind the branchiæ remain isolated and simple, the third presents two processes, viz. the setigerous and an antero-ventral papilla, and this continues in the six subsequent feet. The following (from the tenth) setigerous processes, which are somewhat conical, though antero-posteriorly flattened, remain simple, and the first (tenth) of this (posterior) series has a small papilla below it at the end of the hook-row. There are twenty pairs of bristle-tufts.

The first hooks occur opposite the third setigerous process, that is, the second behind the branchiæ, and they occupy the summit of the elevated ridge which extends from the bristle-tuft downward to the ventral groove, and cover in short the external aspect of the ventral longitudinal muscles. They are in a single row in the first six segments, but the rest are in a double row, and this continues to the commencement of the last thirty. After the cessation of the bristles the uncinigerous processes form transverse crescents in each segment, gradually, however, becoming smaller until on the slender terminal region in front of the tail they form a series of papillæ, so that the ventral ridge

on each side is moniliform. The first hooks are distinguished by the great size of the main fang, which has a crown of small hooks above it—about three being usually visible in lateral view, and by the comparatively small size and oblique nature of the base, which has above its dorsal angle an abrupt incurvation, whilst on its anterior edge it has a sharp point, for the attachment of a tendon, and a gentle incurvation beneath it. The modified form of these early hooks is indicated by the imperfect condition of those at the end of the row. By-and-by they form a double row and assume the typical condition in which the great fang is proportionally less, the base less elongated, its lower edge more convex, and the curve below the point on the anterior edge less pronounced. About four small hooks are visible above the great fang in lateral view.

Polymnia nesidensis, Delle Chiaje, the sixth representative, is a smaller species than *Terebella nebulosa* and of a firmer consistence, which is found on both shores of Great Britain and Ireland. The cephalic region has a less developed dorsal collar than in *T. nebulosa*, and it is not usually folded backward as in the species mentioned, and, moreover, no eyes are present in many of the preparations. The upper lip in front of this forms a large frilled process, and the lower lip is also prominent. A median tongue-like process lies above and internal to the latter. In extreme protrusion of the mouth-parts some have the lower lip folded backward ventrally with a smaller and larger fold above it, whilst in others the lower lip projects downward and outward as a cyathiform process marked by a fold at each side.

The body is comparatively small as compared with *T. nebulosa*, is convex and smooth dorsally, deeply grooved ventrally from the ventral shields almost to the tip of the tail, which in perfect examples has two longer median and two lateral cirri on the ventral surface, the rest of the vent being crenated or with short papillæ. The groove abuts on two rounded lateral ridges, probably marking the ventral longitudinal muscles, and bearing the elevations or lamellæ for the hooks. The segments are two-ringed. Two segments following that bearing the lower lip have a lamella at their outer edges ventrally, and are opposite the first and second branchiæ. The anterior, indeed, often stands out as a frill on the front edge of the shield. In all, about sixteen shields are present ventrally, and they bear traces of the two-ringed condition of the segments generally. They are narrow and transversely elongated in front, broad and transversely shortened posteriorly.

The branchiæ are three in number, the anterior being the largest, the second and third regularly diminishing. In proportion to the size of the body they are somewhat larger than in *T. nebulosa* and they have a stiffer outline. They are dichotomously branched, and have very short terminal divisions — a distinctive feature when contrasted with *T. nebulosa*.

The setigerous processes are seventeen in number, the first occurring close to the base of the last branchiæ. The bristles are long, translucent, slightly yellowish, and finely tapered, and, as usual, in two series, a shorter and longer. In the latter the wings are narrow and indistinct, in the former they are broader and easily recognized, but they do not proceed to the finely tapered extremity of the bristle. A curvature of the tip occurs at the winged region. Little difference exists between the first bristles and the last, except in the fewer number as contrasted with the middle groups.

The rows of hooks commence on the second bristled segment, and they are comparatively short to the seventh bristle-bundle, the last ten of the region being longer. Moreover, whilst they form a single row in front, they are arranged in a double row posteriorly (eleven to twenty segments, *Marenzeller*), the great fang in each pointing to a median line between the rows. Behind the bristles the hooks are borne on an uncinigerous process or lamella, and form shorter rows than in front. These lamellæ have a concave distal margin anteriorly, but posteriorly the tip is bioid, and the processes diminish much toward the tip of the tail.

The hooks somewhat resemble those of *Polymnia nebulosa* in general form, but are readily distinguished by the presence of a second tooth above the great fang and the somewhat shorter base.

In *Polymnia nebulosa*, Montagu, the seventh species, which is found on both sides of Scotland, England, and Ireland, the cephalic region is distinguished by the great size of the upper collar or arch, and by its frilled inward curve at each lower edge. Its upper surface is somewhat flattened, that is to say, only a shallow groove is present, the mass of tentacles springing from the posterior half near the rim. These tentacles are pale orange in life and spotted with white, so as to give them a barred appearance, and their movements are remarkable, for not only do they aid in the construction of the tube, but hoist the animals up the perpendicular side of a glass vessel or in any direction, and are

continually moving as a series of complex threads. All are deeply grooved. When the annelid is hidden amongst shells and tufts of *Ceramium*, the long spreading tentacles resemble independent Nemerteans, and in large examples stretch nearly a foot from the body. Below the mouth is a transversely elongated fold, and then the broad lower lip which ceases at the dorsal fold on each side.

Behind the dorsal collar are a large number of dark pigment-spots, the so-called eyes. These are generally concealed by the posterior fold of the collar. In a small variety met with under stones between tide-marks at St. Peter Port, Guernsey, they are both numerous and distinct, and, moreover, remain in spirit. They form, in a large Irish example, a conspicuous brown band below the collar.

Body 9-10 inches or more in length and as thick as the little finger behind the bristles, soft and mobile, with numerous (60-90) narrow segments, the anterior region being enlarged and the posterior tapered to a comparatively large terminal anus with a crenate margin. Though the dorsum, as a rule, is convex, the preparations are generally marked by a slight median groove anteriorly. Ventrally, a deep median groove runs from one end to the other. In large examples the swollen anterior end is tessellated, whilst in the smaller this is less evident.

Each segment consists of two rings, one at the bristle-tuft and one in front of it dorsally, and these are continued ventrally, the groove in the ridge for the hooks being opposite the bristle-tuft, and only a narrow space occurring between them (the ridges). Posteriorly, the segments are more definitely marked, the broader division containing the lamella for the hooks, a narrow ring being in front of it. Then the two rings are only indicated laterally above the lamellæ for the hooks, and finally, for some distance at the tail, each segment is undivided, and, moreover, the segments become more and more minute as they approach the last, which is broader than those in front of it and has a minutely crenate margin. The ventral surface in this region is considerably diminished, whilst the dorsal arch is increased. The ventral glandular shields are narrow and long in front, broader and shorter from side to side from the fifth backward, and they often present a median precess laterally in front of the point of contact of the hook-row. They are usually fourteen or fifteen in number, the anterior narrow shields being ridged (two-ringed), the posterior flattened. Occasionally an abnormality occurs in the arrangement of the two rings anteriorly, the broad posterior ring ceasing like a fold in the middle line.

The branchiæ are three in number on each side, and have a dull red colour spotted with white. The first pair are about 1 in. long in large specimens, and arise from the second body-segment, which has a spout-like fold at each side. The main stem is often unbranched for some distance, whilst in others (large) a small branch or two occur close to the base. The whole organ is sub-dichotomously divided, the short terminal divisions giving a character to the mass, which appears to form a dense arbuscle. In many of the divisions the branches spring from one side only, but this does not appear to hold in the distal divisions. The ring at the base of the first branchia trends evenly away from it to the frill near the external margin of the mouth. A small papilla sometimes occurs close to the base of the second branchia, it may be only on one side; whilst ventralward the anterior fillet of the segment has a free process like a flat papilla. Close to the outer base of the third branchia is the first setigerous papilla, and a short distance ventralward is a similar free flattened process to that described on the previous segment.

In young examples the branchiæ are comparatively simple, though the terminal divisions correspond in general structure with that of the adult, and in a small littoral variety from St. Peter Port, Guernsey, the branchiæ are likewise less bushy, though the terminal branches are typical.

The setigerous processes are seventeen in number, commencing, as indicated, at the third branchia and continuing for sixteen segments thereafter. Each is a somewhat flattened papilla with the bristles arranged in a vertical row in the centre. The first tufts of bristles are smaller, the bristles themselves shorter, but they show two groups, as in the posterior, viz., a shorter series without evident wings, and a longer series also without evident wings, and with slightly curved and tapered tips. In the middle of the bristled region the longer pale golden bristles have stout striated shafts of nearly equal diameter, and tapering tips with wings. Many of these seem to have been broken in life, and show regenerated (?) tips. The striæ at the commencement of the wings are oblique. The shorter bristles are more translucent, and have either no wings on the free portion or very narrow ones.

The hooks commence on the segment behind that described as having the triangular fold in a line with the last branchia—that is, they occur in the segment behind the branchiæ. At first they are in a single row, but posteriorly in this region they form an alternate double row along the

centre of the ridges, which pass in front from the bases of the setigerous papillæ to the edge of the ventral scutes, and behind these almost to the mid-ventral line. With the cessation of the bristles a change ensues, for the hooks are now borne on a prominent lamella—slightly crescentic or scoop-shaped,—and placed laterally at the posterior edge of each segment, which still consists of two rings. These lamellæ diminish in size posteriorly, becoming minute toward the tip of the tail, and on them the hooks form a close series in a single row. The hooks are distinguished by their elongated basal region, which has a median convexity, then curves upward at the anterior edge, which has a small process for the ligament. A process occurs on the anterior margin about its middle, a double curve meeting at this point. The large fang is well developed, and has only a single tooth above it in a lateral view. The posterior margin has a deep incurvation. The hooks vary chiefly in the shape of the basal region.

The next and eighth form, *Lanice conchilega*, Pallas, is everywhere distributed on the sandy shores of Britain.

The cephalic region is distinguished by its comparatively small dorsal collar, the rim, however, expanding at each side into a great lateral flap which in some almost meets its fellow of the opposite side in the mid-ventral line behind the lower lip, its outline in this region forming a V. In others, the union of the lateral regions is more complete ventrally, some fusing so as to form a continuous band with only a slight concavity in front, thus probably indicating the normal condition as a complete ventral web, the median gap being due to accidents. A marked characteristic is the disposition of the anterior margin of the tentacular surface, for it is contracted into a frilled spout-like border surrounding the mouth—except in violent protrusion. Within the aperture are two folds, an outer smaller and an inner larger tongue-like fold. Cunningham and Ramage consider the large lower lip and the absence of eyes characteristic of *Lanice* as contrasted with *Terebella*.

The tentacles have the usual grooved structure, and form a dense mass of mobile organs. In the centre of the living tentacle under pressure a pale band of muscular fibres proceeds from the base to the tip. The other parts of the wall appear to consist of an inextricable series of muscular fibres—longitudinal, transverse or circular, and oblique. In the interior of the tentacles are numerous cells, but whether free or adherent is not evident, though they do not separate

on laceration of the wall. They are slightly yellowish, and to some extent refract the light. In its native habitat the tentacles are partially protected in extrusion by entering the hollow processes of the fringe of the tube.

The three branchiæ form conspicuous and finely-branched tufts on each side, the first pair being the largest. All are sub-dichotomously branched, and the terminal divisions are fine, so as to give the arbuscles a characteristic appearance. Moreover, they also have a whorled aspect towards the tip. The ultimate divisions are translucent, and have obscure longitudinal striae, with cells and granules in the wall. The first pair is situated on the narrow segment immediately behind the collar, and a trace of which is seen in front of the glandular ventral shield.

The long body is moderately dilated anteriorly, and gently tapered to the tail, at the tip of which is the terminal anus surrounded by a series of marginal papillæ. The segments are numerous, viz., from two hundred to two hundred and eighty. The dorsum is rounded, the ventral surface grooved throughout—often with a central ridge,—except the anterior shields, which extend from the lower lip almost to the termination of the bristles. This glandular surface is divided into segments—generally two in each body-segment—by transverse furrows. Posteriorly it becomes narrow and ends in the median groove about the last bristle-bundle. Besides, a glandular belt occurs at each side in the line of the bristle-bundles, after the manner of the corresponding belt in the *Maldanidæ*, and it is continued backward considerably behind the bristles.

The first segment is very narrow, and is enveloped laterally by the free collar of the next segment. It bears the first pair of branchiæ, and forms a narrow rim in front of the glandular ventral shields. The next has a greatly developed anterior lamella or collar, which stretches from the edge of the ventral shield almost to the second branchia—thus forming the second process of this kind on each side. The following segment has the third branchia and the first bristle-tuft, but bears no hooks: The bristles are bound firmly together in flattened fascicles and slope outward or obliquely upward and outward, and have a pale golden hue. The bristles have a pale base, a shaft with fine striæ internally, and a tapering tip with a double wing, the latter being obliquely striated. The first tuft is smaller and the translucent tips less definitely formed than those which follow, but the structure is essentially the same. The second series of bristles in each tuft is considerably longer than in

the previous forms (c. g., *T. nesidensis*), the tips almost reaching the commencement of the wings of the distal series. Dr. Williams states that the number of bristle-bundles on each side is sixteen, but he had probably omitted the first. In transverse section the central region of the bristle presents the aspect of severed fibres.

From each setigerous process an elongated and somewhat elliptical eminence, having a double row of golden hooks along the centre, passes ventrally. Each has a stout base which narrows upward to the curved neck, above which are the great fang and two teeth on the crown—in a diminishing series in lateral view. Curved striæ extend downward from the small teeth on the crown. The basal part of the hook is marked by radiating striæ. In the anterior hooks the third tooth on the crown is less distinct than in the posterior. In front view two teeth occur in the middle of the crown. The double rows are so arranged that the hooks lie back to back with the fangs pointing outward. The one set may, by fixing, arrest the egress of the animal, and the other may, in the same way, stop ingress. In some of these rows, sixty-six hooks occur on one side and sixty-seven on the other, and in a second sixty-two and sixty-four respectively, so that the combined effect must be considerable. The rows are somewhat longer in front, and the first (opposite the second bristle-tuft) has only a single series of hooks. The anterior rows also have the glandular wedge which dorsally envelops the bristle-tuft, and has its apex about the middle of each interspace. By-and-by, however, this glandular tissue diminishes into a narrow longitudinal belt between the last six bristle-tufts, the shortened eminence for the hooks touching the base of the bristles. With the cessation of the bristles, the rows of hooks are confined to the lateral uncinigerous lamellæ, which continue to the posterior end, gradually diminishing in size as the slender tail is reached. The lateral glandular belt is also continued from the bristled region backward between the hook-lamellæ, but stops short of the tail. On these uncinigerous processes the hooks form a single row along the anterior edge, and at one end of the row a series of imperfect hooks make a curve, those least developed having only a striated main fang, whilst those touching the complete series show a crown above the fang, the base of the hook being absent. The minute processes on the tail have few hooks.

The ninth representative, *Loimia gigantea*, Montagu
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(*medusæ*, Savigny), is a southern one from the shores of Devon and neighbouring areas.

The cephalic lobe presents a small and inconspicuous dorsal collar, which at each side bends down to disappear in the general plate, and without joining the supra-oral arch, which is fan-shaped and projects little. The space between the latter and the cephalic collar is occupied by the grooved tentacles. From the outer border of the cephalic region a large lamella arises and passes with a slight median excavation entirely across to the other side—forming thus a great post-oral platform. A differentiation on each side occurs in the form of a curved line, which extends from the segment-junction posteriorly obliquely forward and outward, thus marking off a central and more flexible region and two stiffer lateral regions. The great development of this post-oral flap is characteristic of the species.

The body has the typical Terebellid outline—enlarged in front, and tapering gradually to the posterior end, at which is the terminal anus. It is rounded dorsally, flattened ventrally in front and slightly so posteriorly.

The segment succeeding that bearing the post-oral lamella carries the first pair of branchiæ, but is not distinguishable, in the sole example available, from the next segment either dorsally or ventrally, though it may represent in the dorsal region part of the segment in front.

The following segment, carrying the second pair of gills, has a broad fan-shaped flap at each side about midway between the gill and the ventral scute; whilst the following, or fourth, segment bears the third branchia and the first bristle-bundle. The ventral scutes in the example are not separated by the deep furrows so characteristic in other forms, but appear to be nearly continuous from the anterior broad scute to the narrow median ridge about the eleventh bristle-tuft. All the segments are marked by narrow rings.

The branchiæ are comparatively small, distinctly separated, and with short stems, the usual gradation occurring from the first to the third. They are distinguished from all the others by their very finely-branched terminal divisions. The main stem and its subdivisions are short, so that the entire organ in each case projects proportionally little. It is dichotomously divided. The branchiæ of the Mediterranean so-called *L. medusæ*, though also furnished with fine terminal ramuscles, are more lax in branching, the separate divisions being longer.

Seventeen pairs of prominent setigerous processes occur

anteriorly, and the bristles are directed outward and backward. Each consists of a flattened brush, with the edges dorsal and ventral, of pale golden bristles, the tips of which are in two series, a longer and a shorter. Each bristle slightly dilates above its pale bulb to near the origin of the wings, when it tapers to a fine point. The wings are of moderate breadth, and cease before reaching the delicately-tapered tip. The bristles of the shorter series have the same structure, but their shafts are more slender. They extend about as far as the commencement of the wings of the longer series. No noteworthy difference between the first and the last tuft occurs.

The rows of hooks commence at the second bristle-tuft, and are long in front, diminishing in length backward to the ninth or tenth, and again increasing at the fourteenth setigerous process—that is, behind the median frill, which succeeds the scutes,—only a brief space separating the long rows in the mid-ventral line, and the same condition is found at the fifteenth. At the sixteenth and seventeenth setigerous processes the rows are shorter, as also is the mid-ventral space between them. The uncinigerous lamellæ which succeed are almost ventral in position, being separated only by the narrow ventral surface (Montagu's dorsum), and they continue to the posterior end (absent in the example). Double rows of hooks occur from the seventh to the sixteenth.

The hooks have a long anterior border, with four or five teeth in diminishing series above the great fang, making five or six in all, and there is no process on the edge of the base beneath the main fang. The posterior outline is boldly convex (opposite the teeth), curving inward to a notch which separates the irregularly convex base. Several striæ pass obliquely from the upper teeth to the posterior border. The posterior hooks are somewhat less, and the curves of the posterior outline and base slightly vary. The foregoing hooks (Pl. II. fig. 5) differ from those of the Mediterranean species (Pl. II. fig. 6), which have a process on the edge of the base beneath the main fang, and the curvatures also differ. If this form represents Savigny's *L. medusæ*, then the British species should be called *L. gigantea*, Montagu.

In the ubiquitous *Nicolea venustula*, Montagu, the tenth species, the cephalic collar forms a small rim dorsally, and behind it is a row of distinct eye-spots. The anterior border makes a spout-shaped aperture by forming an arch over the mouth, which, seen from the dorsum, narrows a little in front, whilst in lateral view it slopes from above downward

and backward. The tentacles are numerous, and have the median groove so characteristic of such organs. Ventrally the dorsal collar terminates, in spirit-preparations, in a short edge.

The body is enlarged in front, though in the small specimens this is slightly marked, and tapers to a moderately slender tail, at the tip of which is the anus. The segments vary from forty to fifty-five. The dorsal surface is rounded, the ventral with thirteen shields in front, and the median line thereafter is marked by a deep groove.

The branchiæ are two in number, and vary much according to the age of the specimen, young forms having only short stalks without divisions, whereas adults have the branchiæ well developed and more or less dichotomously divided—with short terminal branches. The anterior gill is the larger. All intermediate forms occur between the one stage and the other. The best-developed branchiæ occur in those from deep water, *e. g.* 80 fathoms off North Uist, Shetland, the first pair having a comparatively long stalk before splitting into the terminal tuft. The disproportion between this and the second pair is marked, the latter being a short process with only a few divisions.

On each side are fifteen bristle-bundles, consisting of translucent bristles with shafts which slightly diminish toward the upper end, where the narrow wings commence and continue on the somewhat long and finely tapered tips for a considerable distance, disappearing, however, on the hair-like extremity. The tufts differ, *e. g.* from those of *Amphitrite gracilis*, in being single, no shorter series occurring as in other types. The first bristle-bundle occurs behind the second branchia, and it has no apical appendage, but the two following have on the dorsal side of the setigerous process, and continuous with it, a lanceolate process like the branchia of *Aricia*.

The hooks present a single tooth above the main fang, though in some traces of a second appear in lateral view. The base is somewhat small in proportion to the crown and neck, and its lower edge is evenly convex. The process on the anterior edge curves upward, so as to make a narrow gulf below the great fang, and the edge beneath it is concave. The posterior or dorsal edge has only a slight indentation before joining the base. A series of striations pass from the crown down the posterior part of the neck.

In the widely-distributed *Pista cristata*, O. F. Müller, the eleventh species, the cephalic plate has a thick dorsal collar

and the margin passes externally and ventrally to join the anterior fold, though it does not run evenly into it, a notch or a fold separating it from the raised anterior fold, which sometimes has a median projection with symmetrical lateral curves, or in others slight frills. This anterior or supra-oral fold does not project so far forward as in many Terebellids, and it sometimes shows an inner fold over the mouth. The pale orange tentacles seem to be of moderate length and grooved, but are somewhat more slender and tapered than in ordinary Terebellids. Below the mouth is a well-developed tongue-like process, which pushes the rim of the first segment backward when it projects, and ventrally it has a narrow rim.

The body is comparatively short, and in the preparations is less dilated anteriorly than in the ordinary Terebellid. It tapers posteriorly to a slender tail with a terminal anus, which has four large rounded papillae, two dorsal and two slightly more prominent ventral. Dorsally the body is rounded, ventrally flattened at the shields in front, and then grooved throughout the rest of its extent. Anteriorly behind the dorsal collar the setigerous papillae approach the median line, where a bifid process occurs in front of them, and from the sides of the divisions the branchial stem originates—not always in the same place, for in some the right branchia springs antero-laterally in regard to the right process, whilst the left branchia arises behind and to the left of the left process. The free margin of the first segment forms a continuous fold ventrally, which ends dorso-laterally in a rounded free flap, and a process is continued dorsally beneath its edge to the representative of the setigerous process, which lies immediately behind the bifid cone formerly mentioned. The next segment ventrally has a large free lateral flap on each side, whilst the median is differentiated into a narrow scute. The following segment has a still larger lateral flap, which stretches further outward and upward and almost touches the base of the branchial stalk in the preparation. It thins off toward the narrow scute in the mid-ventral line. Laterally it ensheaths the lamella in front of it.

The ventral scutes are about seventeen in number, besides four or five small terminal median scutes, and after them a median groove with a raised line continues to the posterior end. Behind and above the third and fourth bristle-tufts a smoothly-rounded process or long papilla occurs, and in some two are found behind the fourth. In the Irish examples they are clavate. Occasionally a smaller papilla occurs behind the fifth.

The branchia on each side arises by a long trunk in the line of the second large lateral flap (third segment) and quite on the dorsum. The distal region is finely branched, the whole forming a whorled arbuscle so characteristic of the genus. Occasionally a third and smaller stem springs from the segment in front, and its branches have the same arrangement. In an example from Shetland two large branchiæ of different sizes sprang from the second segment, and two smaller, also of different sizes, arose from the third. In some the whorled condition is conspicuous in tier after tier leading to the somewhat truncate tip. It is noteworthy that the branchiæ cling to segments 2 and 3.

The next segment (fourth) bears a setigerous process and a ridge, but no hooks are present. As indicated, the anterior setigerous processes are dorsal in position, but they soon become lateral. Those in front and rear are less permanent than the median processes. The pale golden longer bristles have nearly cylindrical shafts, the proximal ends being narrowed only for a short distance, and they are finely striated, whilst the distal ends are curved, tapered, and soon end in a fine point, the sides of the tip having well-marked wings. The tip is curved and directed dorsally and posteriorly—that is, the convexity is in front. The shorter bristles have little more than the tips projecting uniformly beyond the surface of the skin, and they show the same form and curvature of the tip.

The hooks commence opposite the second setigerous process—that is, the fifth segment—as a single row, and the ridges leave a considerable interval between them and the scutes. The rows remain uniserial till the ninth or tenth, when a biserial arrangement occurs. The hooks have a rather short, stout, main fang, with three or four teeth above it in lateral view, and oblique striæ from these to the posterior outline of the neck. The curve below the main fang is slightly angular and wide, whilst the median process on the anterior outline forms a short cone with a broad base, the line then trending at a different angle downward. The posterior outline is nearly straight, very slightly convex, then it bends outward at the point of attachment of the ligament, which passes off above the lower margin of the base, and thus the appearance of the hook is diagnostic. The basal region is comparatively deep, and has a process at its anterior and inferior angle. The long ridges for the hooks cease with the bristles, and thereafter uncinigerous processes project from the posterior border of each segment, the glandular tissue forming a belt between them. Posteriorly the processes bear a single row of hooks.

Pista cretacea, Grube, the twelfth species, is readily distinguished, amongst other characters, by the peculiar hump on the posterior outline of the hook just above the base. It comes from the south-west of Ireland and other regions in deep water,

The Hebridean example of *Scione maculata*, Dalyell (?), the thirteenth form, has the cephalic region so injured that all that can at present be said about it is that it appears to correspond with that of allied Terebellids.

Body apparently about $2\frac{1}{2}$ to 3 inches in length, and of the typical outline. In spirit it had at first a reddish-brown appearance, and was everywhere speckled with white, with the exception of the ventral scutes.

The number of the pale golden bristle-bundles is unknown. The shafts are nearly cylindrical till near the end, where they are slightly narrowed below the wings. The tip is gently tapered to a fine extremity, and furnished with a narrow wing on each side.

The hooks are distinguished by the straightness of the posterior border and by the presence of only a single tooth above the large fang, which stands nearly at a right angle to the posterior outline. The anterior outline below the great fang is not elongated, and has the process for the ligament about its middle, the edge beyond it having a slight incurvation. The basal region is deep and comparatively short in contrast with that of *Terebella nebulosa*, another form having only a single tooth above the great fang. The inferior outline is convex, with a slight sinuosity at either end. On the whole, the general outline of the hook approaches that of *Pista cristata*, while materially differing in detail.

The southern *Lepræa lapidaria*, L., the fourteenth species, has on the cephalic plate a well-marked dorsal rim, which curves laterally to become continuous with the highly-arched supra-oral fold, often thin anteriorly. It bears numerous slightly-grooved tentacles, which also differ from those of many other forms in adhering after preparation. They are pale yellow in life, with the red blood-vessel in the centre. The buccal process or "tongue" inferiorly often projects as a smoothly-rounded mass obscuring the rim of the segment behind it. The structure of the cephalic region of this inhabitant of fissures in rocks does not differ materially from those which dwell in tubes, except that the lingual process or boss is large and that the tentacles show only a slight groove at the base, and it seems to disappear from

the rounded distal region, which is tapered and ends in a slight knob.

The body is comparatively short and firm and has the typical shape—enlarged in front and tapered posteriorly, whilst the dorsal surface is smoothly rounded to the level of the ridges for the hooks, and the ventral surface is marked by a deep groove behind the scutes. Anteriorly the dorsum is minutely striated transversely, and behind the branchiæ it is finely tessellated after the manner of *Scalibregma*. On the ventral surface are about twelve central shields, which are of a brighter red than the rest of the body, and behind them a white median stripe (marking the nerve-cord) is continued to the tip of the tail, where it blends with the pale hue of the region. The first segment, with its rim behind the lower lip, is whitish, and each scute has a transverse whitish streak at its posterior border. The ridges for the hooks are somewhat paler than the general surface, and five of the anterior ridges have a glandular white patch between them and the bristle-tufts; indeed, each setigerous process has a glandular patch in front and behind. The dorsum throughout is dull brownish, inclining to purple in its native site, and merging into orange-brown near the tip of the tail, at which the anus is surrounded with small but distinct papillæ (six to eight, *De St. Joseph*).

The branchiæ are three in number on each side, the first the largest and the third the least. Each arises by a short stem, which divides somewhat dichotomously, but the terminal divisions are both dichotomously and pinnately divided, the whole having the aspect of a finely branched bush. In life they have a pale whitish-pink hue.

Two ridges run from the ventral scutes toward the first branchia; but they are devoid of hooks and bristles. The first bristle-bundle is borne by the setigerous process opposite the second branchia. The pale golden bristles form two groups, a shorter and a longer. The former have nearly cylindrical shafts up to a slight narrowing below the wings, which are minutely serrated at the edge, followed by a slight enlargement as the wings arise. After tapering considerably the axis ends in a translucent knife-blade tip, the base of which is thickened into a process representing the termination of the axis, and the rest is flattened out to form the terminal blade, which tapers somewhat suddenly from the broad base to a fine hair-like extremity, the edge opposite the process having a thickened rim, whilst the other is minutely serrated. Malmgren's artist has not very accurately interpreted the basal part*.

* Annul. Polych. tab. xiii. fig. 69 B.

The posterior bristles are brittle, and few remain after capture. They have the same structure, but the knife-edge process at the tip is shorter and the serrations of the edge longer and coarser.

From first to last the setigerous processes are closely associated with the ridges for the hooks, and indeed form part of them, finishing, as it were, the dorsal end by a pointed process. Anteriorly the process is nearly transverse, but by-and-by it slopes backward, especially posteriorly, where the bristles pass from its posterior and upper angle.

The hooks commence on the ridge, passing from the first bristle-tuft ventrally toward the shields (fifth segment, *De St. Joseph*), and the succeeding ridges gradually increase in prominence until they are conspicuous latero-ventrally. The first row is single, but at the eleventh a double row occurs, and this continues a considerable distance, but on the small posterior ridges only a single row is found. The typical hook has a large main fang and three teeth above it, the posterior margin is nearly straight, its distal end curving to the crown, and its basal bending outward to form a process of the base. The latter is of moderate length, convex inferiorly, and with a sinuosity in front. The curve beneath the great fang is abrupt and ends in a prominent process, and below it a curve goes to the anterior prow. Although only three teeth are observed above the great fang in profile, numerous teeth appear when the crown is viewed from above. In the first row of hooks the bases are altered, the anterior prow being prolonged, and the sinus above the bases posteriorly being more pronounced than in the typical hook. Anteriorly the outer edge of the groove for the hooks is free, so that it sometimes resembles a papilla.

From the Zetlandic seas comes *Laphania boccki*, Malmgren, the fifteenth form, in which the cephalic lobe is so little developed that at first sight it has some resemblance to a Maldanid. The dorsal collar, however, is present, and the plate passes obliquely forward to make a fairly firm arch over the mouth. From the surface of the plate spring a series of moderately elongated grooved tentacles. A small tongue-like process lies in the pit below the mouth, whilst the lower lip is thick and curved.

The body is slightly dilated anteriorly, remains for some distance of nearly the same diameter, and then gently tapers to the tail. In the preparations the anterior end is generally curved ventrally so as to resemble a Maldanid—as, indeed, the firmness, the ventro-lateral ridges, and the posterior segmentation also do. It is rounded dorsally, flattened

ventrally anteriorly, and grooved posteriorly, where the segments are marked by deep dorsal furrows. Following the buccal are two somewhat narrow segments, each having a setigerous process, and a glandular ventral scute or belt. Ten scutes follow, the last separated by an interval. Then the median ventral groove continues to the posterior end.

Seventeen setigerous processes occur on each side carrying pale golden bristles, and they are conical when viewed from the dorsum, obliquely truncated at the tip when viewed laterally. They commence on the third segment. The bristles are in two series, a longer and a shorter. The former are long, slender, translucent bristles, the free part being apparently cylindrical to the commencement of the wings, but the shaft is actually slightly enlarged till it almost reaches its base in the tissues. The tip is comparatively short, finely tapered, and the wings are distinct. The shorter forms have shafts very slightly less than the foregoing, and only their ends project beyond the skin, the wings commencing at once and dilating into broad expansions, whilst the short but finely tapered tip is curved at an angle.

The rows of hooks commence on the seventh setigerous segment, though in the form examined it was on the eighth counting from the first (small) setigerous papilla. The anterior hooks somewhat resemble those of *Pista cristata*, with three or four teeth above the main fang, a posterior outline convex toward the crown, then a hollow, and a projection above the posterior long ligament. The deep base is convex inferiorly, and the anterior outline has a process under the main fang. The figure of Malmgren is incomplete, though it is correct as far as it goes; that of Ssolowiew is not well finished.

The crowns of the posterior hooks are higher than those in front, and are more nearly in accordance with Malmgren's figure, five or six small teeth being above the main fang, and the posterior basal process is represented only by a short fragment.

In the widely distributed *Thelepus cinnamatus*, O. Fabricius, the sixteenth species, the dorsal cephalic collar is well-marked, and has posteriorly a series of eye-specks, whilst the external rim passes downward to the ventral surface and joins the lower edge of the supra-oral arch. A comparatively short space thus intervenes between the two sides ventrally, a space which is occupied by the inner tongue-shaped process and the short fillet of the post-oral segment. The supra-oral arch is moderately prominent, but limited in extent, and

often forms a small spout-shaped process. The anterior surface of the cephalic plate is occupied by the tentacles, which are of a pale flesh-colour or orange with or without red specks. They are long, powerful, and marked here and there with whitish opacities probably from the peritoneal corpuscles, which roll backward and forward in their interior. In some examples they are of a deeper hue than those of *Terebella nebulosa*, probably from the presence of the reddish specks. These mobile organs are grooved throughout, and are sometimes flattened in a spathulate manner and again contracted and richly crenate. Under the structureless cuticle is the cellulo-granular hypoderm, then follow the fine but tough non-striated muscular fibres, circular and longitudinal. In life the slender vermiform tentacles coil and twist in every direction, now showing nodular enlargements and again extending into a uniform thread as before, or actively wriggling as if each were endowed with independent life. Each granular tentacle, when separated from its attachment to the cephalic plate, coiled itself in spasmodic jerks or gently unfolded. By their aid, as in other Terebellids, the annelid pulls itself upward on the perpendicular wall of a glass vessel. The tentacles at the ventral angle of the cephalic plate are small and short.

The body is typical of the Terebellids—viz., enlarged anteriorly and tapered gently therefrom to the posterior end, where the anus, surrounded by about a dozen papillæ, is terminal. It is rounded dorsally and more or less rugose or warty in old and large specimens anteriorly, rounded also anteriorly on the ventral surface, then flattened and slightly grooved, the groove continuing almost to the posterior end. The segments are distinctly marked throughout, the anterior presenting dorsally four transverse lines, and the longer and narrower posterior segments a larger number. The ventral scutes (glandular thickenings) are well developed, and can be distinguished as such as far back as the thirtieth bristle-bundle. Moreover, a thick glandular coat invests the body laterally—enveloping the tori and the setigerous processes in each segment. In large examples from the Arctic seas the anterior scutes are rugose transversely and cut into various folds in each segment.

The feet are represented by setigerous processes and tori uncinigeri. The first setigerous process arises dorso-laterally below the second series of branchiæ, and the others follow in succession at the posterior part of each segment, the glandular investment of the region passes above it and forms a finished edge dorsally. The succeeding processes gradually

incline to the lateral region, and posteriorly to the ventro-lateral region. The bristles form a vertical fan in each process—narrow at the base and spreading out distally. Moreover, they are arranged in two alternating series—a longer and a shorter, the tips of the latter only projecting beyond the surface. They are shorter than those of *Lanice conchilega* and less slender, and the wings are more distinct. Each bristle has a pale base, gently dilates into the widest part of the shaft, then forms a nearly cylindrical and slightly narrower region to the wings, after which it tapers to a slender curved tip. The wings are narrow both anteriorly and posteriorly, where the bristles are shorter. As Grube and Marenzeller point out, the bristles do not, as Malmgren observes, go to the posterior end, a considerable number of the terminal segments being devoid of them. Thus, in an example from Balta about forty of the posterior segments had no bristles. As the tufts of bristles decrease, the uncinigerous processes become more distinct. In imperfectly preserved specimens the cuticle falls off and the bristles cling to it by their tips, probably from the enlargement caused by the wings, but the edges of the wings may also be concerned.

The branchiæ form two tufts of simple filaments on each side, arising from a transverse ridge in each case on the second and third segments, the anterior ridge being the longer, passing also farther down the side (ventrally) and with more numerous filaments, which are often prettily waved in a spiral manner when the animal is at rest. They are of a pale straw or deep orange colour with a red streak in the centre from the blood-vessel which is most distinct immediately after a contractile wave of the body drives the fluid forward. As they arise from two segments they can scarcely be called "one pair," as in the 'Catalogue of the British Museum.' In a young example, half an inch in length, these organs formed two distinct groups on each side, the first containing two or three filaments of different lengths, the posterior only one. They are enveloped in a transparent structureless cuticle, and the hypoderm has finer cells and granules than the tentacles. Longitudinal and circular muscular fibres are also present. The branchiæ seem to vary in different races, and some of the largest from the Arctic seas have short thick filaments.

The bristle-tufts range from thirty to forty-one or even fifty-three (*Marenzeller*), and in transverse section the bristles are somewhat ovate, sometimes approaching a short or blunt ellipse.

The first row of hooks is on the fifth segment, the first two elevations being devoid of them. On the fifth the row is at the posterior part of the segment at some distance ventrally from the setigerous process. They increase a little in length after the first, and remain nearly the same for a considerable distance, gradually, however, becoming elevated so that about the twenty-fifth prominent uncinigerous processes are formed, and posteriorly they stand out like the "feet" of caterpillars. Toward the tip of the tail they diminish on the narrow segments, and incline ventrally so that those of opposite sides approach, and they cease at the last segment. In an example from St. Andrews the uncinigerous processes are irregular posteriorly, being crowded on one side and scantily distributed—even with blanks—on the other, probably from injury. The hooks are arranged in a single row throughout and are smaller than those of *Lañice conchilega*, but more numerous—no less than one hundred and thirty-seven occurring in a row anteriorly, but posteriorly the number diminishes. Each hook in lateral view presents a single tooth above the great fang, though occasionally a minute third is visible. The posterior outline is short and has a dimple, whilst the base is elongated and convex inferiorly. The anterior outline (below the great fang) is smooth and often slightly convex, and merges into the prow (anterior part of the base), which is prolonged as a stout process with a slightly dilated tip, so as to resemble a stud. The occasional occurrence of a second tooth above the great fang brings the *Heterophenacia renouardi* of Marion *, from Marseilles, nearer this species.

Thelepus triserialis, Grube, the seventeenth form, is a southern annelid, in which the cephalic collar and the arrangement of the parts of the anterior end are similar to those of the foregoing species, but no pigment-specks remained in the preparations behind the collar, though in life they were present.

A distinction, however, immediately appears in the branchial region, the surface of which is more extensive, the filaments more numerous and more slender. Moreover, they arise from three segments, viz., the second, third, and fourth. The first and largest forms a transversely elongated row of filaments on segment 2, its outer edge passing ventrally considerably below the first bristle-tuft behind it. The second springs from the dorsum of the third segment

* Revue des Sc. nat. t. iv., March 1876.

within (*i. e.* dorsad to) the first bristle-tuft, and is smaller, whilst the third, which is somewhat larger, arises on the dorsum opposite the second bristle-tuft. The first pair is widest apart, the third pair most nearly approach each other.

The body generally resembles that of the foregoing form, but is often smaller, and the dorsal and ventral surfaces, glandular scutes, and plates do not materially differ. The bristle-tufts range from thirty-three to forty, the posterior region, in one of forty segments, being devoid of them, as in *T. cincinnatus*. It tapers posteriorly to a slender tail, and the uncini-gerous processes seem to go on to the tip, thus differing from those of *T. cincinnatus*. The anus appears to have a papillose margin.

The first bristle-tuft arises opposite the second branchia, and, as mentioned, is above the level of the first branchia, and the setigerous processes are continued along the dorso-lateral region to the posterior region, as in *Thelepus cincinnatus*, where they cease. The setigerous processes are vertically flattened in front and throughout the greater part of their course, but posteriorly they diminish to conical papillæ. The anterior bristles appear to be somewhat shorter than in *T. cincinnatus*, but are similarly arranged in two series, a longer and a shorter. The wings in both are slightly broader than in *T. cincinnatus*, both sets of bristles being proportionally shorter and thicker. They increase in length in the middle of the body, but posteriorly diminish both in size and number, especially before ceasing, yet retaining the same arrangement as regards shorter and longer series. The wings in the terminal bristles are narrow. All the bristles have a pale golden hue, and, whilst the first few sets of bristles are directed outward, the majority slope outward and backward—the terminal tufts, however, in the preparations, projecting outward or even slightly forward.

The rows of hooks commence on a fillet on the fifth segment (that is, opposite the third bristle-tuft, at the posterior part of the segment), and they slightly increase in length to the fifteenth series, when a gradual diminution occurs, the rows, moreover, by-and-by being elevated on processes, and, instead of being nearly straight, they are convex forward about the twenty-fourth, and this arrangement appears to be retained in the longer posterior uncini-gerous processes, where they occur on the anterior face of the tip. As the bristles diminish and disappear, the uncini-gerous processes increase in prominence, and are ventro-lateral in position. Finally, they are minute toward the tip of the tail. The hook is similar (generally) to that of

- *T. cincinnatus*, yet differs in detail. Thus it is proportionally larger, the base longer, the stud at the anterior end of the base (prow) has a different angle to the outline, is truncated at the tip, and the process beneath is more prominent, though there are variations in this respect; moreover, traces of a second tooth on the crown above the great fang are common.

The cephalic lobe in the eighteenth species, *Grymæa bairdi*, Malmgren, is truncate in lateral view, a feature due to the flattened arch of the supra-oral fold, which in many Terebellids forms a spout- or hood-like projection. The surface of the cephalic plate, from which the tentacles arise, is thus nearly vertical. The dorsal collar presents no eye-specks in the preparations, and curves downward to join the supra-oral fold externally and ventrally. The tentacles agree with those of *Thelepus*, being well developed and having a deep groove with frilled margins.

The general outline of the body agrees with that in *Thelepus*, though the details differ. It is enlarged anteriorly and tapered posteriorly, no example, however, being complete. The dorsal surface is rounded and smoother than in *Thelepus*, the ventral surface flattened and posteriorly slightly grooved. Anteriorly are ten or eleven glandular ventral shields, which may be wrinkled in the preparations, and the outer edges of which touch the rows of hooks. A glandular belt accompanies the setigerous region, but it is not so pronounced dorsally as to form anteriorly the definite edge as in *Thelepus*, though posteriorly it is well defined. The ventral surface behind the shields is more thinly coated with the glandular tissue, and a thickened median ridge continues for some distance backward.

The Norwegian examples appear to be smaller than ours.

Though *Thelepus triserialis* agrees with *Grymæa bairdi* in having three pairs of branchiæ, yet their arrangement in connection with the bristle-tufts differs. In the present form a branchial tuft of several filaments occurs on the anterior edge of the second segment, but its attachment is above the line of the first setigerous process, which is likewise on the second segment. Behind is a second tuft of branchiæ with fewer filaments, and which is in a line with the first setigerous process of the left side, whilst on the right it is opposite the second setigerous process. The third is a prominent group of about six filaments opposite the third bristle-tuft. The individual filaments are similar to those of *Thelepus*, though in some they are longer, and the

first set arises from a transverse ridge, which, however, does not pass externally below the line of the bristles as in *Thelepus*. On the whole, the area covered by the branchiæ is longer antero-posteriorly than in *Thelepus*.

No more distinctive feature between *Grymæa* and *Thelepus* exists than the great size of the setigerous process and the length of the bristles. The first setigerous process occurs on the second segment, and it is slightly shorter than those which follow, whilst in the region of the shields the processes form long lamellæ with slightly expanded tips set obliquely like the blades of a series of oars, the ventral edges of which are curved and split for the extended line of pale golden bristles. Moreover, when the process is removed, a distinct twist like the blade of a propeller occurs in all the pencils of bristles, a condition closely connected with the functions of the bristle-tufts. As in *Thelepus*, the setigerous processes spring from the posterior part of each segment, and are dorso-lateral in position. Two ranges of bristles occur in each tuft, a longer and a shorter, the latter alternating with the former. The longer bristles have nearly cylindrical shafts inserted deeply in the tissues, but they taper from the surface distally, so that where the narrow wings commence considerable diminution has occurred, and they taper after a second expansion to very fine, hair-like, curved points. The shorter forms are much more slender, but they also taper to hair-like points and have narrow wings. The dorsal edge of each fascicle is bounded by three or four strong bristles without the intervening shorter and more slender forms, whereas the ventral edge has shorter and more slender forms.

The number of bristle-tufts is about thirty-two, and the region behind has only uncinigerous lamellæ. The posterior bristles present a broad, almost flag-like wing.

The first row of hooks commences opposite the fourth bristle-tuft, that is, in a corresponding position to that of *T. triserialis*, though in the latter it is the third setigerous process. The rows are somewhat shorter than in *Thelepus*, and they are sooner elevated on ridges, indeed at the eighth or ninth a distinct lamella is apparent, and at the twenty-fifth it forms a fan-shaped flap with the single row of hooks in a curved line on the anterior face of the edge. The first row of hooks is distinguished by the apparent length of the base, but this is due to its narrowness. The typical hook has two distinct teeth above the main fang, the posterior outline is deeply indented, the anterior outline (below the great fang) has a peculiar stud which leaves it at an obtuse

angle, whilst the prow is continued beyond it to end in a process for a ligament, and the base is convex inferiorly and has a process at the end of the posterior outline.

The cephalic region of the generally distributed *Polycirrus aurantiacus*, Grube, the nineteenth form, has even more voluminous folds than in *Ereutho*, the plate being frilled anteriorly as well as forming the two broad folds posteriorly. Moreover, dorsally is an indication of a collar in the shape of a smoothly rounded ridge, the whole being occasionally spread as a wide border to the oral region, which thus assumes the form of a shallow funnel. The entire outer surface gives origin to the dense series of dull yellow tentacles, which form a seething mass of threads—slender, flattened, and fusiform. Each tentacle extends even to a greater degree than in the red variety, becoming paler when stretched, though still retaining a trace of the yellow hue. Their extensibility and elasticity are remarkable, and the thinnest strand presents a minutely cellular appearance with a central streak. The smaller and shorter tentacles occupy as usual the edges of the posterior lobes, so that when the flaps are adpressed they are close to the fissure leading to the mouth. In the red variety the tentacles form an inextricable mass in a vessel—enclosing other annelids, fragments of shells, *Balani*, and mud. When much stretched the tip, which is generally the widest part, is pinkish, the attenuate region below it being pale, and the intermingling of these hues, especially against a dark background, is striking.

A specimen of moderate size can stretch its tentacles three or four inches, the processes being dilated at the tip, but of extreme tenuity toward the base, and the corpuscles of the cœlomic fluid are observed in the centre.

When viewed from the dorsum the slight dorsal collar runs on each side and bends downward behind the projecting fold of the anterior arch, and it sometimes happens that a median fold in front divides the tentacles into two symmetrical series after the manner of *Phoronis*.

Instead of the single large post-oral scute of *Ereutho*, *Polycirrus* has a tongue-shaped median glandular process, the edges of which are free, and the anterior border runs smoothly forward to the mouth. In one example this process is bifid posteriorly, whilst a small area is cut off anteriorly, the whole being symmetrical. It may represent the first scute.

The body resembles that of *Ereutho*, and, like it, is in
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the preparations almost always coiled, only the tail is generally more tapered than in the genus mentioned. It is rounded dorsally and often dilated anteriorly, grooved ventrally, and terminating posteriorly in the anus, which may have a simple crenate margin, though it generally shows a more prominent ventral papilla, occasionally a smaller dorsal papilla, or both a dorsal and a ventral, or, in the case of a red example, with two dorsal papillæ or flaps and a ventral. Probably much depends on the condition of the region with regard to reproduction. In the preparations dilatations occur dorsally, both in the region of the scutes and, when this part is contracted, in the region behind.

The ventral scutes commence with the median tongue-shaped one already mentioned, and laterally are two small scutes on each side, each of which abuts on a bristle-process (first and second). Each of these has its inner edge bevelled by the encroachment of the median scute. Six pairs of scutes follow, for the deep median furrow separates the respective sides. A rounded glandular scute of small dimensions is conspicuous on several of the succeeding segments, which have a longer antero-posterior diameter than those in front. A glandular belt also envelops each bristle-tuft anteriorly, and is continued, though less distinctly, posteriorly, where the uncinigerous processes are more evident than the setigerous. In the large northern variety from the Hebrides and Shetland the glandular thickening at each bristle-tuft is in some developed ventrally in the preparations, so that four rows of scutes appear to be present.

The pale golden bristles slope outward and backward from setigerous processes of considerable length anteriorly, which are bifid dorsally, the longer process being posterior, and the margin curves inward ventrally. The setigerous processes become smaller in their progress posteriorly, and cease before reaching the tail, the process itself showing only the longer posterior papilla, the shorter being indistinguishable. The number of the setigerous processes seems to be variable, ranging from thirty-five to sixty, and, whilst the anterior are conspicuous, the posterior are not easily observed. The translucent pale golden bristles are in two groups, a longer and a shorter. They are widest at the pale base, and gradually diminish distally, where they taper to a fine point, which is curved. The longer and stronger bristles are dorsal, the shorter and less robust ventral. The shorter forms are much more slender, their tapering tips alone projecting beyond the surface.

The uncinigerous processes commence on the ninth

setigerous segment as a low elevation with a short row of hooks, which in outline differ from the typical forms in the middle of the body, insofar as the base is shorter and proportionally thicker, and a considerable elevation occurs on the anterior outline beneath the main fang. The typical forms have an elongated base slightly turned up at the prow, a posterior outline deeply indented above the basal process, an anterior outline with a slight projection below the great fang, and a somewhat convex inferior (basal) outline. The main fang is proportionally large in comparison with the neck and the tooth above it is of moderate size. A feature of these hooks is that whilst in lateral view the prow is narrowed toward the point, in a view from above the end of the prow is flattened and chisel-shaped. The uncinigerous processes, which are somewhat prominent posteriorly, continue to the end. The row of hooks is on the anterior face of the tip. In the large northern variety from Shetland and the Hebrides the base of the hook is somewhat thicker posteriorly.

Dorsally the cephalic plate in the twentieth species, *Polycirrus elisabethæ*, McIntosh, arises in front of a prominent ring somewhat crescentic anteriorly and apparently continuous with the post-oral segment. The supra-oral frill is similar to that of *P. aurantiacus*, but its lateral folds differ, the boss or projection caused by them being farther forward and more conspicuous, and in the preparation the median fissure runs to the anterior border and forms a spout-like projection there. The tentacles have a similar structure, and form a mass like that of the common species. When extended the cephalic plate forms a wide and frilled margin to the funnel-shaped oral region, and the median scute is smoothly rounded ventrally.

The body has a similar outline to that of *P. aurantiacus*, but the species is smaller, and the posterior margin finely tapered, the edges being serrated by the uncinigerous processes, whilst the anus has two dorsal papillæ and a more prominent mid-ventral papilla. The surface is rounded dorsally and grooved ventrally. Anteriorly the mid-ventral shield is proportionally larger than in *P. aurantiacus*, and is somewhat lozenge-shaped in form, the anterior angle being carried forward to the mouth. Behind it is a narrow fillet followed by seven pairs of conspicuous glandular scutes and a series of smaller which follow. Glandular extensions occur laterally at each setigerous process. The segments are marked by narrow rings as in the former species. So

far as could be observed, the general arrangement and number of the setigerous and uncinigerous processes agree with those of *P. aurantiacus*.

The anterior setigerous processes, which commence on the second segment, appear to have a slightly longer posterior papilla dorsally than in the former species, but the bristles are similarly arranged in a longer and shorter series, the latter being more numerous ventrally. The bristles are devoid of wings, are translucent pale golden, and in lateral view present a slight enlargement before tapering to the delicate tip, which is slightly curved. The shorter forms have a more attenuate hair-like tip, and also present a trace of an enlargement below it. The posterior bristles are shorter, more slender, and fewer in number in the small tufts.

The uncinigerous processes commence about the ninth bristled segment, and occur in a single row. Anteriorly the hooks are small, have a much shorter base than in *P. aurantiacus*, and the inferior outline rises into a convexity behind the slender prow, while posteriorly it juts into a process. Two or three teeth occur above the main fang, and a distinct process projects from the anterior outline just beneath it. The depth of the base posteriorly and its abrupt slope to the prow give a character to the hook. Comparatively few seem to be in each row.

The twenty-first form, *Ereutho smitti*, Malmgren, is another extensively distributed species in which the cephalic region is characterized by the absence of a distinct dorsal rim, the smooth spout-like supra-oral fillet passing forward in the median line, and, each side bending downward, forms a broad rounded flap at the ventral edge, the arrangement being symmetrical. The external margin curves outward and upward—almost to the dorsal edge,—then doubles sharply backward as a fillet and ceases. When the neck is viewed from the dorsum these fillets are conspicuous on each side. From the entire surface of this cephalic plate arise the dense mass of bright yellow tentacles which form inextricable coils both in life and in spirit, and from the edges of the lateral flaps are many small filaments. They are mobile grooved organs capable of endless changes—now flattened and again rounded, coiled and twisted in various ways, or again corrugated and wrinkled. The body is pulled along by these organs which move like linear Nemerteans over the glass. The tentacles in life show a pale central streak under a lens, and their sides are dotted with

minute yellow granules. The small tentacles at the margin of the cephalic lobes keep constantly coiling, and the animal soon covers itself in a glass vessel with debris of various kinds, and through the meshes of its cover the long delicate tentacles everywhere emerge. These tentacles are ciliated on the ridges and their muscular fibres form meshes, and though no circular coat is apparent the oblique and connecting fibres would to a large extent supplant them. From the nature of the parts no prominent ventral lip is present, but the narrow part of the first glandular ventral scute glides under the ventral flaps of the cephalic plate and runs into the smooth surface which trends as a shallow groove forward to the mouth.

The body is more or less dilated anteriorly, sometimes being largely distended, and it tapers posteriorly to the tail, which in the preparations is by no means slender, though in life it is often much more attenuate. It is rounded dorsally, grooved ventrally, and has numerous segments, 50-88 or more. Posteriorly it terminates in a crenate anus, the central papilla ventrally being the most prominent. Occasionally the anus is carried outward on a small process or appendix, but such may be due to regeneration. Anteriorly are thirteen pairs of setigerous processes, and behind these about seventy or more uncinigerous processes, which occupy the ventro-lateral region.

The segment behind the mouth has a single large glandular ventral scute, narrow in front and broad and rounded posteriorly. Then a narrow belt follows, its lateral regions expanding to include the second setigerous processes. Thereafter a median band with a central line passes longitudinally backward, cutting the scutes into pairs in every segment, and of these seven or eight are distinct, each marked by transverse lines. The segments of the posterior region have a deep furrow in the preparations dividing them into two, and each of these is again subdivided into three narrow rings.

Viewed from the dorsum each setigerous process is dorsally bifid, a feature better marked in the smaller than in the larger examples, and the bristles issue between the limbs. The first setigerous process has a considerably longer anterior cirrus than those which follow, the posterior process being smaller. In the middle of the body the anterior process is shorter and thicker and the posterior process is more distinct, whilst the last setigerous process in one has a rounded boss on the tip of the thick, short, anterior process, and the posterior is at a greater distance from it and smaller

than in the middle of the series. From this bifid region the tip is curved downward and inward.

The bristles are in two groups, a longer and a shorter series. The former are pale golden slender bristles with shafts that are more slender than their pale bases and taper distally to the curved wingless tip. In the shorter series only the curved tips, which are more slender than the foregoing, project beyond the surface. The margin from which the bristles issue slopes inward as it passes ventrally, and the fascicle has a twist as in *Grymaea*.

The first uncinigerous process occurs as a slightly elevated ridge at the posterior part of the segment following the last bristle-bundle, and the succeeding processes gradually increase in prominence until they form bosses or papillæ, like the feet of caterpillars, along the ventro-lateral region of the body to the tail, the terminal processes being small and closely arranged. The single row of hooks lies on the anterior face of the tip. The anterior hooks show a considerably longer base than that in Malmgren's figure, the anterior outline, below the main fang, having a slight convexity about its middle, whilst at its junction with the posterior outline a distinct shoulder occurs. The main fang is large and acute, and the tooth above it is of considerable size, though not so large as in Malmgren's figure. The inferior outline of the base is slightly convex behind the middle, but generally shows an inflection in its progress towards the prow. The posterior hooks retain the main features just mentioned, though the base is somewhat shorter and a trace of another tooth occurs in some on the crown.

The twenty-second species is *Polycirrus tribullata*, M'Intosh, dredged by J. G. Jeffreys, 90 fathoms off N. Unst, June and July 1867.

The cephalic region, lips, and tentacles are of the usual Polycirrid character; no ventral plates occur, only a somewhat raised central line. This form has a very exceptional structure, even more so than *Lysilla loveni*, for neither bristles nor hooks could be observed in the single example. The skin has a minutely granular aspect under the lens. Three very well-marked, circular, flattened processes existed on each side on the sixth, seventh, and eighth segments, but no bristle or hook was present. Each consisted of an elevated ring externally with a papilla in the centre. Two minute papillæ were visible on the segments (one on each) in front, but only a trace of an elevation on those behind. Each segment anteriorly was two-ringed.

From the Zetlandic seas comes the twenty-third form, *Lysilla loveni*, Malmgren. In this the cephalic plate passes forward from a small dorsal collar and is thrown into various folds, the edges of which appear to be somewhat thinner than in *Polycirrus*, and hence show a more elegantly frilled margin. Ventrally the plate forms a broad flap fixed laterally, but with the inner edge (and flap) free. The surface is covered with numerous clavate and grooved tentacles, but the ventral flaps have clusters of more minute filiform ones. The mid-ventral region behind the mouth has a large and prominent tongue-shaped process—smoothly continuous with the oral surface anteriorly, where it is fixed; it is free and somewhat conical posteriorly. In lateral view it forms, indeed, a spout-like process at right angles to the body with an elevation (glandular) in the centre.

The body is enlarged anteriorly and marked by the two lateral rounded bands, minutely tuberculated and ringed, the largest tubercles or papillæ being on the ventral surface of the longitudinal bands. The segments are not distinctly defined, except by the setigerous processes in front; but Malmgren states that the posterior region (absent in the British example) presented about twelve deep sulci. He gives the length of 30–50 mm., and the width of the tumid anterior region as 5–6 mm., that of the posterior part 2–2.5 mm., and the latter, though minutely ringed, is smooth.

Six setigerous processes occur anteriorly in the groove, though no bristles are visible under a lens. Each consists of a slightly conical process with a curved tip, and presenting a white streak in the interior due to the bristles, which consist of a single closely arranged fascicle of simple translucent bristles, which curve distally in conformity with the outline of the process and end within the tissues at the tip. Except for stiffening the setigerous processes, these bristles are thus devoid of function.

In *Trichobranchus glacialis*, Malmgren, the twenty-fourth form, the cephalic lobe differs from that of *Polycirrus* in its reduced condition. Dorsally it has a groove separating it from the first segment, and is provided with two eye-spots, the lobe then projecting forward as two symmetrical rounded bosses flanked on each side by a translucent free flap. From the surface springs a dense series of tentacles—filiform and fissiform. The filiform are pale pink in colour and—like the larger, clavate, grooved, red-streaked ones—keep up a continuous movement. The translucent lateral flaps are devoid of tentacles. The distinction between the three groups of

appendages is distinct in some preparations. The branchiæ are coiled, the posterior small tentacles filiform, whilst the larger are clavate and grooved. The mouth opens in the centre above a line joining the attachments of the translucent lateral flaps, and in a groove between the two prominent anterior bosses.

The body is Terebelliform in appearance, about an inch in length, enlarged anteriorly, and tapered posteriorly to terminate in an anus with two cirri. It is rounded dorsally, grooved ventrally, and has about seventy segments. The mouth opens anteriorly at the furrow between the bosses, the translucent lateral flaps curving inward to be attached on each side. Ventrally is the tumid and streaked lower lip which forms the conspicuously truncated anterior end. The grooves generally show a symmetrical arrangement, a broad median belt passing down the centre, flanked by two or three stripes on each side, the ventral ends being split. The second segment forms a continuous ring dorsally and ventrally, and sometimes projects forward dorsally, so as to ensheath the posterior cephalic edge and the eyes. It bears dorsally the first branchia on each side, a single thick and proportionally long filament tapered distally—distinguished by the bright red central vessel and often by the spiral condition. The third and fourth segments also bear a pair of gills, which readily fall off in the preparations.

The short setigerous processes, which have oblique tips, commence on the sixth segment and are fifteen in number. Each tuft has two series, a longer and a shorter. The longer bristles are pale golden, one half free and one half inserted in the tissues, the shafts dilating a little from the base, then remaining cylindrical till the commencement of the very narrow wings, which have minute striæ directed outward and upward, after which they taper to a fine hair-like curved tip. They thus appear to represent the first stage of the development of wings on a bristle. The bristles slope outward and backward in the preparations, but are directed forward in life, the convexity of the terminal curve being in the same direction; the shorter forms often alternate with the longer, and their number corresponds nearly with that of the longer, viz., six in each tuft. There is also a slight gradation in the size of the longer bristles from the dorsal to the ventral edge.

Below each bristle-tuft is a row of hooks with elongated curved shafts, which increase from the base upward to the shoulder—above which the neck is distinctly narrowed, the head again expanding so as to resemble with the main fang

a bird's head. Above the main fang the rounded crown has a series of four smaller teeth. This kind of hook is characteristic of the bristle-bearing segments.

A series of vertically flattened uncinigerous lamellæ occur on the succeeding segments, and some are broader at the tip than the base. They bear at their apices a row of minute avicular hooks, having short, broad, basal processes with a convex inferior outline, a posterior outline in which a deep sinus occurs above the basal process, and an anterior outline which in some has a trace of a process beneath the main tooth. The latter is of moderate size, but the teeth above it are proportionally large, so that this hook does not present the disproportion between the first and succeeding teeth present in the long anterior hooks. In lateral view four or five teeth occur above the great fang, and in reality they form a rounded crown with their points curved obliquely downward. Malmgren, while noting the distribution of the hooks from front to rear, does not sufficiently define the structure of the posterior hooks.

As widely distributed is the twenty-fifth species, *Terebellides stroemi*, Sars, in which the cephalic region is almost as blunt as in *Trichobranchus*, though the great elevation of the frilled cephalic plate is characteristic, since it rises from a slight collar high above the dorsal outline and has a boldly folded margin, the two sides meeting in the middle line inferiorly, and forming a spout-shaped channel, the sides of which behind the mouth in some are thickened. The cephalic plate thus has the surfaces directed anteriorly and posteriorly, instead of dorsally and ventrally as in *Polycirrus* and other forms. The edges of the plate posteriorly give origin to the tentacles, which are of a pale flesh-colour, grooved, often spoon-shaped, and, though not stretching much, coil actively in every direction.

The body is enlarged in front and gently tapers to the tail, which is by no means slender. It is smoothly rounded on the dorsum and only in well-preserved examples are the lines of the segments indicated. On the other hand, the ventral surface presents anteriorly the bold glandular belts, the representatives of the scutes of other members of the family. Besides, a great glandular semicircular lamella is placed immediately behind the spout-shaped fold of the cephalic plate and separates the oral from the succeeding region, and is evidently of great physiological importance. A narrow glandular ring follows, the convex central region being in some separated by furrows from the lateral regions,

which diminish as they go outward. A broader ring, the second body-segment, which bears the branchiæ dorsally, then follows, the central region of which is likewise marked off by two furrows from the lateral regions. This ring is partly overlapped by the broad glandular belt, which stretches from side to side of the next segment and clasps the setigerous process at each side. Four similar ventral belts follow, diminishing as they go, and then the succeeding belts are narrow, separated by increasing breadths of non-glandular tissue. Further, an almond-shaped area beneath each setigerous process is differentiated, and on this the hooks appear on the sixth bristled segment, and thereafter it becomes the uncinigerous process.

The branchiæ arise from the second and third segments by short, somewhat bulky, and fluted stems, which are flattened antero-posteriorly. The two main divisions are dorsal, each having a smooth basal process directed backward and a fusiform dorsal region composed of lamellæ, which from the stem backward abut on the smooth basal process, whilst the lamellæ of the portions in front of the stem are fixed to a median ventral band. These lamellæ are highly vascular, the vessels or channels forming a close series of arches from twelve to eighteen in number along each leaflet, the free margin of which is crenate. The posterior branchiæ are much smaller, but they also have a basal trunk to which the lamellæ are attached. The lamellæ are more or less conical, having a distinct apex to which the vascular channels point, and thus they are more or less straight and nearly vertical. A coagulated fusiform mass occurred in the basal trunk of one. In the tube the branchiæ are turned forward with the basal region, the smaller pair uppermost and the lamellæ next the dorsum.

The first setigerous group commences on the second segment, at the upper or lateral edge of the ventral glandular belt, and below it is a slightly curved elevation with the convexity anterior. Seventeen setigerous processes follow. Each is short and stout, with a slightly bevelled tip grooved for the bristles. The first and second are smaller, and they slightly diminish posteriorly. The pale golden bristles have long and nearly cylindrical shafts, a little narrowed at the proximal end and distally tapering to a somewhat stiff curved tip, which ends in a hair-like point. The tip has narrow but distinct wings. The bristles appear to be in a single series—the stouter dorsal and the more translucent and slender ventral in position.

The rows of hooks commence on the sixth segment and

continue to the posterior end. In the bristled segments anteriorly they occur on slightly elevated ridges a short distance below the setigerous processes, with the exception of the first which is close to the base of the process. The ridges become more prominent before the bristles cease. The rows are often conspicuous from their brownish colour. The golden hooks of the first row not only diverge in position, but in structure, for they are larger and longer, have translucent shafts which dilate a little above the base, and again gradually diminish to the neck which is curved backward, the tip being bent at a little more than a right angle and tapered to a sharp point—slightly turned up in some. The second series shows hooks of the normal outline, besides others imperfectly formed—with shorter shafts, and slightly curved bifid tips,—a distal longer and another shorter process at a distance below it. The typical hook has a long, slightly curved, finely-striated shaft, which is slender at the base, dilates gradually in its progress to the shoulder, near which it diminishes, the neck then being bent a little backward, the enlarged crown having four teeth above the main fang, which is powerful and sharp.

The uncinigerous processes become more prominent on slightly flattened lamellæ with wider truncated tips behind the bristled region, and attain their maximum about the twentieth before the end, and gradually diminish backward. In this region the hooks are all of one kind, and essentially different from those in the anterior region. Each hook has a convex posterior region with a deep dimple above the base, three large teeth above the main fang, the anterior outline presents a slight process below the main fang, and the base is convex inferiorly and short, the somewhat abrupt anterior outline making but a short process. The importance of the form and of the functions of hooks are well illustrated in this species, which has no less than three kinds.

3. *On the Terebellidæ dredged by H.M.S. 'Porcupine' in 1869 and 1870, and by the 'Knight Errant' in 1882.*

A variety of *Amphitrite cirrata* was procured in 690 fathoms at Station 3, 1870, and various rare Terebellids from depths ranging from 160 to 358 fathoms. *Pista cristata*, O. F. M., was dredged at Stations 2 and 6 (Atlantic), 1870, and *Thelepus cincinnatus* from 81 fathoms off Cape Finisterre and 795 fathoms at 17 b (Atlantic), *Laphania boeckii* in 567 fathoms; whilst *Trichobranchus glacialis*, Malmgren, occurred at Station No. 3 (Atlantic), 1870, and *Terebellides stroemi*,

Sars, eight miles off Cape Sagres in 45 fathoms, off Cape Guardia, and nine miles off Cape Finisterre in 81 fathoms.

Amphitrite affinis, Malmgren, which extends from Ireland (Southern) into the Atlantic, where it was dredged by the 'Knight Errant' at Station 11, 23rd August, 1882, in 555 fathoms. There is a well-marked dorsal collar without eyespecks in the preparation, and which laterally folds round to join the supra-oral plate, which is somewhat scoop-shaped and only moderately prominent. The tentacles appear to be normal. The body is typical, so far as it goes, and rounded dorsally, whilst ventrally are twelve distinct shields and several rudimentary ones posteriorly. Behind the mouth is a transverse shield, which dorsally joins the smooth region behind the collar. Two segments with ventral shields follow, the dorsal edge of the first passing to the base of the first branchia, whilst the dorsal edge of the second falls short of its branchia. A still larger gap separates the first bristle-tuft of the next segment from the third branchia. Behind the shields a deep groove occupies the ventral median line.

The branchiæ are three in number, proportionally small, and with short and rather thick terminal divisions. The first has a short stem, which splits, each branch carrying a few short filaments, some with bifid tips. The second is a little less, and the third is again still less. Both sides are alike. There are seventeen pairs of bristle-tufts, the first commencing opposite the third branchia. The bristles are pale golden, the shaft being deeply inserted in the tissues, only a short free portion occurring below the wings, which are narrow and soon cease, the translucent tip beyond being flattened like a long knife-blade, boldly serrated at the edge, and tapered into a very long hair-like tip. One or two shorter forms occur amongst the others, but apparently no regular series as in other genera, and they are probably developing long bristles. In these little of the winged region projects beyond the surface, and the flattened blade beyond is occasionally split into spikes. Amongst the bristles are long curved forms with narrow wings and finely tapered tips.

The hooks (Pl. III. fig. 2), when fully developed, form a double row, the large fang facing that of the opposite hook. The base is comparatively small and the crown and neck large. The crown presents in lateral view three teeth above the main fang, which is long and sharp. The posterior border is convex and a marked heel occurs as it joins the base. The curve below the main fang has a median process, and beyond it is an abrupt bend, whilst the anterior process

or prow is rounded and blunt, striæ pass from the small teeth on the crown along the posterior part of the neck.

The cephalic region presents a broad horseshoe-fold over the mouth—continuous at its outer and inferior edge with the larger collar which bounds the tentacular area posteriorly. A deep groove, wide in the middle and tapered at each side, is thus formed. Below the mouth is a short fold bounded by the first-mentioned horseshoe-arch at each side, and ventral to this a broader band or lip.

The body has a normal shape, viz. enlarged anteriorly and then gradually tapering to the posterior end. There are seventeen pairs of bristle-bundles, which commence on the fourth segment and extend to the twenty-first. The winged tips do not show serrations under a power of 350. Each of the three branchiæ arises from a single basal portion, and extends as simple slightly curled filaments therefrom, the tips being slightly tapered. They seem to be considerably shorter than those of *Amphitrite cirrata*, O. F. M. Twelve ventral shields or plates occur in front, the first being immediately behind the posterior labial process, and a ridge (marking the nerve-cord) is continued from the last along the ventral groove to the posterior end.

Marenzeller describes the colour of the body as reddish grey, brownish in front, and pale posteriorly. Tentacles streaked and punctated with brown. In the examples from the 'Porcupine' brownish pigment still remained anteriorly at the cephalic folds and between the ventral shields. The bristles issue from an elevation at the dorsal edge of the ridge for the hooks, and they form a vertical series in each tuft. Moreover, six small papillæ (third to ninth) occur immediately beneath them, and situated at the posterior border of the ridge for the hooks.

The hooks differ from those of *A. cirrata* in the shorter and less oblique base, which thus forms a different angle with the crown. Four teeth occur above the main fang, as in *A. cirrata*. The elevations or pads for the hooks are long in front, stretching from the dorsal bristle-tufts almost to the ventral groove. Behind the bristled region they form small but prominent lamellæ along each lateral region, and there is little difference in structure between the anterior and posterior hooks. The former are in a double row, the latter form a single series.

This differs from *A. cirrata* in the position of the papillæ at the anterior setigerous processes, and in the absence of the adjoining flap at the dorsal end of the rows of hooks.

Laphania boeckii, var. *hystricis*, was dredged in the Expe-

dition of 1870 at No. 1 in 567 fathoms, and has sixteen pairs of bristles. The cephalic lobe has no dorsal collar, and the plate arches over the mouth, a series of the usual grooved tentacles arising from its surface. It differs from a Canadian *Laphania* in having a free ventro-lateral flap or collar at each side of the cephalic plate. Behind this, on the dorsum, another collar occurs on the succeeding segment, and it attains its maximum depth laterally—ceasing as it reaches the ventral surface.

The body is only slightly enlarged in front, and tapers gently to the posterior end with its terminal anus. The dorsum is rounded, the anterior ventral region flattened, and the rest grooved posteriorly. The number of segments is over thirty, but the example is incomplete. Eleven or twelve ventral scutes seem to be present.

Sixteen pairs of bristle-bundles occur anteriorly, each having comparatively few bristles issuing from the somewhat conical process. The longer bristles are translucent, shorter than in the other form, and with a comparatively short, winged, tapering, terminal region. The tips have a slight curvature. The shorter forms have only their tips projecting, and their wings do not seem to be broader than those of the longer bristles, and just a trace of a curvature occurs at the tip. The first setigerous process is on the third segment. The number of the bristle-tufts agrees with Malmgren's *Scione*, but the hooks so closely resemble those of *Laphania boeckii* that further investigation is necessary.

The rows of hooks appear to commence with the bristles, and anteriorly their outline (Pl. I. fig. 12) approaches that of *Pista cristata*, though they are considerably smaller. The crown has at least five teeth above the main fang, the anterior outline has a prominent median process with an indentation below it and the prow is rounded. The posterior outline has an eminence above the ligament, and the inferior outline of the base is slightly convex. From the hook of *Pista cristata* it is distinguished by its smaller size, the shape of the crown, and the increased number of teeth above the main fang, by the greater bulk of the base in the hook of *P. cristata*, and by the difference in the anterior outline—chiefly caused by the deeper inflection below the median process. The posterior hooks are smaller, have a proportionally larger crown, a more uniform anterior outline, and do not usually show the powerful ligament at the posterior end of the base.

4. *On the Chaetopteridæ, Amphictenidæ, and Ampharetidæ dredged in the Gulf of St. Lawrence, Canada, by Dr. Whiteaves in 1871-73.*

The Chaetopterids are represented only by fragments of a *Spiochaetopterus*, probably *S. typicus*, Sars, from No. 9, 1873.

The Amphictenidæ include *Cistenides hyperborea*, Malmgren, dredged in 100-212 fathoms off Anticosti in 1871 and more abundantly on Orphan Bank, Nos. 9 and 16, 1873. This form is distinguished by the dark colour of the paleolæ and their number—viz. twelve to fourteen, though occasionally fifteen may be present,—by their greater breadth than in *Lagis*, and though the tips are finely tapered they are more rigid than those of *Lagis koreni*, by the peculiarly blunt, almost knob-like, condition of the fringes of the veil, and by the presence of seventeen pairs of bristle-bundles. One of the most characteristic features anteriorly is the oral veil, which, instead of ceasing laterally in a line with the anterior cirrus, passes downward and backward as a broad sheath, which envelops most of the oral tentacles like a broad funnel, as in *Cistenides granulata*, a form characteristic of the waters of Greenland. This has similar papillæ on the margin of the veil, but only nine or ten paleolæ in its crown. The anterior and posterior bristles closely resemble those of *Lagis koreni*, though, on the whole, the stronger anterior (simple) bristles have broader shafts in the latter. The caudal hooks of the Canadian species are less tapered at the neck, the curve of the terminal hook less marked, and the point in the British form is also often sharper. One of the most distinctive features, however, is the structure of the minute hooks (Pl. II. fig. 7) on the lamellæ of the feet, which, instead of having six teeth in a continuous row above the minute series of four inferiorly, have but three in increasing size. The process beneath the third usually has three teeth at the tip, as shown by Malmgren, but sometimes four occur, and occasionally only two—apparently from injury. The groove below this process is figured by Malmgren as bluntly and smoothly rounded, but it really shows from above downward a convexity and then a concavity, with a small hook-like tip. The shaft diminishes even more rapidly than in *Lagis koreni*. The anal process has three or four lobes on its dorsal margin behind the hooks, and thus differs from that of *Lagis koreni*, which has a papilla on the tip of these processes.

Stalked Infusoria occur in numbers on the paleolæ.

The tubes (Pl. I. figs. 1 & 2) of *C. hyperborea* present a slight curvature and taper to rather an acute point, and they are large, from 60–70 mm. in length and 8–9 mm. in breadth at the wide end. They do not exhibit the exquisite masonry of *Lagis koreni*, presenting not only a rougher external surface, but an excess of cement hides defects in the joints. The tubes, however, are firm and serviceable, and all are of a dark brownish hue, probably in keeping with their surroundings. The smaller tubes show greater neatness and regularity in their construction, and the cement is confined to the joints—indeed, the larger tubes vary amongst themselves in this respect.

This species has a wide range, having been found in Spitzbergen, Finmark, and Sweden, as well as in Canada and Greenland. On the other hand, *Cistenides granulata*, L., its near ally, does not occur in Dr. Whiteaves' collections; yet it is common in Greenland, its tube (Pl. I. figs. 3 & 4) having fewer sand-grains in a transverse row than in *C. hyperborea*—though interesting, much weight need not be attached to this feature, which depends on the size of the grains. It is recognized by the comparatively few paleolæ in its crown (9–10); a velar process a little less developed ventrally than in *C. hyperborea*, but with similar marginal papillæ; whilst the hooks, which are not figured by Malmgren, show three teeth, which increase in size from above downward as in *C. hyperborea*; but the process beneath them has no evident spikes or they are very indistinct, and the prow below has a similar double curve to that of the Canadian species. In this form also the anal valve (dorsal) is considerably longer than in *C. hyperborea* or *Lagis koreni*, and it projects as a flattened conical process beyond the ventral edge. The margin of the process also is more distinctly fimbriate than in the allied forms. The tube (Pl. I. figs. 1 & 2) has a slight curvature, and, as a rule, the grains are coarser than in *C. hyperborea*, but the cement is neatly adjusted at the opposing edges. It is tapered to a fairly fine point posteriorly.

Amongst the Ampharetidæ is *Sabellides borealis*, Sars, which was not unfrequently procured off Cape Rosier Lighthouse in 1871 and at Stations 35 and 36, 1873.

The cephalic region (Pl. I. figs. 7 & 8) is characterized by its firm shield-shaped plate, which is sloped to a blunt point in front and is sometimes pigmented. On viewing the snout from the ventral surface, a series of distinct eyes occurs as a band on the anterior border of the fold at the base of the conical snout. Moreover, blackish pigment

tints the prominent parts of the lips, which form a curved frilled band on each side of the mouth. The branchiæ are four on each side, attached to the dorsum of the third segment, and two somewhat in front of the other two. They are proportionally small tapering organs and quite smooth. It has laterally a process of the peristomial segment, which also bounds it behind. Ventrally is the mouth, which has a fleshy lip on each side, whilst anteriorly the dorsal surface of these bears the tentacles, which vary much in length in different examples, apparently from their condition as regards reproduction. The base is the thickest part of each, and it is smooth at first, then the organ tapers to the free end, which is in the preparations somewhat clavate and more finely granular than the rest. The processes or "cilia" gradually increase in length, forming conspicuous organs till within a short distance of the tip, which is free from them. Each is a translucent process of hypoderm with a central axis or rod, the outline presenting a slight enlargement at the base and again at the tip, especially in those toward the distal end of the series. The translucent hypoderm of these processes is granular and slightly streaked at the enlarged terminal part, which also occasionally shows palpcils in the preparations, but whether due to the action of the preservative fluid or otherwise is unknown. The axial fibre is structureless and is brittle.

The function of these peculiarly armed tentacles appears to be of a special character, as the central axis in each "cilium" shows. The body is elongated, very little narrowed in front, but considerably tapered posteriorly, where it ends in a tail, having two cirri of moderate length placed ventrally on each side of an anus, which in some presents a slightly crenate margin. The dorsum is smoothly rounded throughout, and the ventral surface is also convex anteriorly, whilst the boldly marked glandular thickening of the segments gives a character to the region, which is nearly co-extensive with the bristled segments, and thereafter a median groove passes backward to the tail. The thickened ventral surfaces of the anterior segments show a slight differentiation of the median line, which, in contraction, is curved backward and by-and-by is somewhat elevated, and thus is in contrast with the fully extended example.

The anterior region has fourteen pairs of setigerous processes, the first of which is dorsal in position, being situated just external to the branchiæ of its side, and the next three gradually slope to the side along which the rest lie. Each tuft consists of a series of longer translucent bristles, having

cylindrical shafts (Pl. II. fig. 2) and slightly curved winged tips, which taper to a fine point. The widest part of the bristle seems to be a little above the commencement of the wings. Besides the main bristles of each tuft a shorter series of winged forms (Pl. II. fig. 3) occur between them, little more than the tips with the wings projecting beyond the surface. The bristles retain the same structure throughout, the curvature of the tips only showing variation.

The anterior hooks commence at the third bristle-bundle, being attached to a slight ridge, which, as the hooks approach more closely to the setigerous process, posteriorly becomes a small lamella. The hooks form a single row and nearly correspond in structure (Pl. I. figs. 9 & 10) with those figured by Malmgren, viz., having a slightly sinuous crown with a peak for the ligament at the posterior angle and five teeth in lateral view, the last being broad and short. The prow is smoothly rounded, and the notch between it and the tooth is wide internally and differs from Malmgren's figure.

So far as can be observed, the number of the posterior lamellæ for the hooks is twelve. They are flattened and somewhat irregularly conical next the bristled region, but soon develop an elongated dorsal cirrus or filament, which continues to the posterior end. The hooks of this region (Pl. I. fig. 11) are considerably smaller than those of the anterior region, have a proportionally broader crown and only four teeth in lateral view. The prow is proportionally larger and the posterior outline more convex.

The tube is composed of fine mud and is comparatively soft. To the exterior are attached filaments of reddish algæ and patches of *Cellepora*. The tube is considerably longer than the body of the animal.

The Terebellidæ dredged in the Gulf of St. Lawrence comprise *Amphitrite cirrata*, O. F. M., off Port Hood, Cape Breton, *Amphitrite*, A. B., off Cape Rosier Lighthouse, whilst a form near *A. grænlantica* was found off Port Hood. *Terebella figulus*, Dalyell, was met with between Cape Rosier and Cape Gaspé in 1872. *Thelepus cincinnatus*, O. Fabr., was dredged in numbers on Orphan Bank, and in 100–200 fathoms off Anticosti in 1871, and at No. 8, 1872. The widely distributed *Pista cristata*, O. F. M., was met with on stony ground in 75–100 fathoms between Cape Rosier and Cape Gaspé. A *Polycirrus* was dredged in 170 fathoms on the same ground. *Lanassa nordenskiöldi*, Malmgren, occurred off Cape George, Nova Scotia, and in various hauls elsewhere. *Artacama canadensis*, a form near Malm-

gren's *A. proboscidea*, was met with in Gaspé Bay and other localities in 30 fathoms, and the ubiquitous *Trichobranchus glacialis*, Malmgren, off Port Hood, and *Terebellides stroemi*, Sars, in 100 to 212 fathoms off Anticosti, off Pugwash, Nova Scotia, and other places.

Several examples of *Lanussa nordenskiöldi*. Malmgren, occurred off Cape George, Nova Scotia, in 1873, and a fragment at No. 6 the previous year. Those from Cape George were in thick and rather long tubes of brownish clayey mud, which presented a smooth inner lining, but no perceptible membrane, and as they had not been specially attended to after capture had decayed. The cephalic lobe has scarcely a trace of a collar dorsally and is small, its inferior lip forming an arch over the mouth. From its surface a series of grooved tentacles arise. Neither eyes nor branchiæ are present. The body is elongated, but, as no complete example has been found, the number of segments is unknown, probably from forty to seventy. It is enlarged anteriorly and tapered posteriorly to a terminal crenate vent. The dorsal surface is rounded and with minutely tuberculated bands in front; whilst the ventral surface, also flattened in the region of the shields in front, is grooved posteriorly. The first three bands of tubercles are narrower than the succeeding, and give a character to this region of the dorsum. A deep groove runs along each side of the body above the ventral longitudinal muscles behind the anterior region.

Fifteen pairs of setigerous processes occur anteriorly, viz. from the fourth to the nineteenth. They are conical when viewed from the dorsum, the tips being flattened and obliquely truncated, so that the dorsal edge projects most. They bear long pale golden bristles, the tips being curved backward, and they occur in two series, a longer and shorter, the stronger and longer of the former being dorsal, the shorter being ventral. Each bristle (Pl. II. fig. 8) has a translucent, faintly striated, flattened shaft, the narrowed base of which is often enlarged at the end. The free portion is slightly narrowed from the surface of the skin to the origin of the very narrow wings, and then the tip is tapered to a fine translucent hair-like point. The shorter forms have only the winged tip free, and they probably indicate a reserve-series.

The first row of hooks is opposite the second bristle-bundle, and the others occupy a similar position throughout the bristled region, being in a single row to the seventh and in a double row thereafter to the fourteenth. Behind the

bristles the uncinigerous rows become slightly more prominent, and soon form conspicuous ventro-lateral processes almost to the tip of the tail. The hooks, which are uniform in structure throughout (Pl. II. fig. 9), are characterized by the elevated crowns, with four or five sharp teeth above the great fang, a convex dorsal outline and a deep incurvation above the base, the posterior angle of which has a well-marked process; the inferior outline is convex, whilst below the great fang is a prominent process from which the outline slopes to the prow.

Artacama canadensis, sp. n., is not uncommon in water of some depth in the Gulf of St. Lawrence. Hitherto the genus has been found chiefly in northern latitudes, such as Spitzbergen and Norway, and has not been met with in the British area. It is distinguished by its bulbous and symmetrically rugose buccal region, from which the everted proboscis in some cases projects as a papillose globular mass with a conspicuous cone at the apex. The cephalic plate is peculiar, for it is produced posteriorly into two lobes, rounded distally, whilst its ventral margin forms a frilled funnel, considerably elevated above the mouth, though the arrangement of the parts corresponds with species in which the mouth is in the central part of the frills ventrally. The plate has a distinct dorsal collar.

The body is enlarged anteriorly, the snout being somewhat bulbous, and tapered posteriorly to a slender tail with a terminal anus. It is rounded dorsally, flattened and grooved ventrally, and the segments are distinctly marked, the anterior having two rings and the posterior three in a large example. Eight of the anterior segments, ventrally, have wide glandular belts, and thereafter are five central glandular shields. In a small example with a complete posterior end the terminal segments appeared to be only two-ringed, and finally only a single ring characterized the nine or ten segments.

The branchiæ are in three groups on the second, third, and fourth segments, and their filaments are smaller than in such as *Thelepus*. Each springs from a central point, from which the twenty or more filaments diverge, and when torn they adhere by their bases.

The anterior region bears seventeen pairs of setigerous processes, which are flattened lamellæ with oblique distal edges, the dorsal being the most prominent, whilst the anterior lip projects beyond the surface. They bear two series of pale golden bristles, viz. a longer and a shorter.

The longer (Pl. II. fig. 10) have finely striated shafts, which slightly diminish to the origin of the wings, the tapering tip having a well-marked curve, which in the preparations has the convexity forward. The edges of the wings seem to be minutely serrated. In the shorter series (Pl. II. fig. 11) the tips only project beyond the surface, and the wings are proportionally broader. The presence of the thin anterior lamellæ in these setigerous processes is noteworthy. A papilla under the middle branchial tuft indicates the commencement of the series, though it bears no bristles.

The anterior rows of hooks, which commence on the second setigerous segment, are comparatively long, those toward the end of the bristled region nearly reaching the elevated mid-ventral line. A change occurs after the cessation of the bristles, for, instead of sessile rows of hooks, uncinigerous processes are developed beneath a foliaceous lamella after the manner of a Phyllodocid. These lamellæ gradually diminish posteriorly, and are minute in the caudal region. The first uncinigerous process and lamella are smaller than those which succeed. At the fourth the uncinigerous lobe is somewhat tongue-shaped with the hook on the dorsal convexity, the shorter inferior curve being bare. The lamella is large and reniform, being fixed by its pedicle at the hilus. The minute hooks (Pl. III. fig. 3) have the same structure both anteriorly and posteriorly, viz., a proportionally large great fang, with five or six teeth in lateral view above it, so that the crown is large, the posterior outline is convex with a deep dimple above the base, which is short and convex inferiorly, whilst the anterior outline has a process beneath the great fang, the prow presenting no peculiarity. These hooks differ so much from those figured by Malmgren that further observations are necessary to ascertain the relationships of the Canadian form.

5. *On the Ampharetidæ and Terebellidæ dredged by
Canon A. M. Norman off Norway.*

The Ampharetidæ occurred at various stations, from 33 to 44, and ranging to 210 fathoms, and they included *Ampharete grubei*, Malmgren, *Amphicteis gunneri*, Sars, *Sabellides octocirrata*, Sars, *Melinna cristata*, Sars, *M. elisabethæ*, M'Intosh, and *Amage auricula*, Malmgren.

Amongst the interesting Terebellids are a form near *Amphitrite grayi*, Malmgren, *Terebella danielsseni*, Malmgren,

Nicolea venustula, Montagu, *Pista cristata*, O. F. M., *Thelepus cincinnatus*, O. Fabr., *Grymæa bairdi*, Malmgren, *Lysilla loveni*, Malmgren, and the following.

Amæa trilobata, Sars.

Dredged in 130 fathoms off Sponholmere, Lervig, Norway, in 1879.

The cephalic lobe has a well-marked and crenate dorsal collar which is continuous with the post-oral fold on the ventral surface, the whole being thrown into various folds. A small tongue-shaped process lies in the centre below the mouth, whilst over it is the large, thin, fan-shaped flap so characteristic of the species. To judge from Malmgren's figures, the parts seem to vary much according to their condition on preservation. From the surface of the cephalic lobe pass off numerous grooved tentacles, the general appearance being such as to cause Sars to place it under the genus *Polycirrus*.

The body is much inflated anteriorly, and, in the present example, chiefly ventrally, and it tapers posteriorly to the tail, which is absent, but which does not seem to be much attenuated in Malmgren's figure. The dorsal surface is rounded and, at first sight, smooth, but is really minutely papillose. The ventral surface in the example is largely distended, projecting considerably on each side of the setigerous processes. The surface of the distended region is more distinctly papillose than the dorsal surface, whilst in the median line are five or six small shields, the last trending into the broad median line, which behind the swollen region passes into the ventral groove, which, with the two lateral sulci above the ventral longitudinal muscles, divides the body into three main regions—a dorsal and two ventro-lateral. The alimentary canal is distended with mud containing sand-grains, a few spicules of sponges, and comparatively few nutritive particles.

On each side anteriorly are ten pairs of long, flattened, setigerous processes, bevelled at the tip; but no bristles are visible, even under a lens. The first has a distinct and somewhat ovoid dorsal lobe, into which the very fine hair-like tips of the bristles go, and a few project beyond the tip. The rest, which are equally fine, appear beyond the edge of the bevelled region beneath. Though so few project beyond the tip, many occupy the process itself, and they are of considerable length and arranged in groups. The processes which follow have similar bristles, but the terminal

lobe is less marked. Only the translucent hair-like tips project beyond the surface. Behind the setigerous region a part occurs in which no processes are present, and then in the groove above the ventral longitudinal muscles on each side is a minute process containing nine or ten bristle-like uncini (Pl. III. fig. 4) with tapered shafts and ends, on each of which Malmgren figures a minute hook. In the example from Lervig only the first of the series is present, but, though the tip is sharp, no curvature could be made out, so that some uncertainty remains.

6. On the Occurrence of one of the Pisionidæ at St. Andrews.

The publication by Mr. Southern of the successful results of the Irish Fisheries Investigations in the group of the Polychæts of the Clare Island district directs attention again to this remarkable type. *Pisone*, from Valparaiso, was originally placed by its discoverer, Grube*, after *Oxydromus*, then included in the Phyllodocidæ, whilst Levinsen† thought it approached the Polynoidæ. Ehlers‡, again, who added a new species to the list, gave the family wide relationships, viz., most nearly with the Aphroditidæ, but also with the Nephthydidæ, Hesionidæ, Syllidæ, and Glyceridæ. Recently Mr. Southern§ has recorded a form for which he has made a new genus, viz., *Prægeria* (the species being *P. remota*), the chief differences from *Pisone* being, he states, the reduction of the head, the backward position of the eyes, the unmodified dorsal cirrus of the second bristled segment (this appendage in *Pisone* performing the functions of a tentacular cirrus), and the absence of the genital papillæ. How far some of these differences may be due to the minuteness and immaturity of the Irish forms can only at present be conjectured. The present note has been made from the fact that, when engaged with the fauna of St. Andrews in 1863, a sketch was made (Pl. III. fig. 5) of an example apparently closely allied to Mr. Southern's, though the globular cirri are not indicated, and the eyes seem to be differently arranged; but in a minute and imperfectly developed form considerable latitude is necessary, especially as only a single softened example was obtained in the Bay. So far as can be observed the relationships already claimed

* Annul. Cæstediana, p. 17 (sep. copy), 1857.

† Kara-Havets Ledorme, p. 6 (sep. copy), 1886.

‡ Polychæt. magellan. Chilen. p. 60, Taf. vi. figs. 1-18.

§ Proc. Roy. Irish Acad. vol. xxxi. no. 47, p. 60, pls. vii. & viii fig. 15, A-II.

are reasonable, and the list might also include the Sphæro-doridæ. The surface-papillæ (Pl. III. fig. 6) closely resemble those of the Chloræmidæ, and the jointed bristles with the bifid tip are not unknown in that family. The end of the shaft is dilated and minutely striated (Pl. III. fig. 8), and the whole organ is thin and fragile. The bristles are minutely spinose (Pl. III. fig. 9), a character which may be larval.

In the Irish example the long bristles are minutely spinose (Pl. III. fig. 9) and by no means stiff, and they appear to be longest posteriorly. The specimen had fairly large ova. The peculiar hooks are disproportionately large and are translucent (Pl. III. fig. 7). The flattened shaft is narrowed at the base (origin), slightly dilates as it goes upward, and ends in a broad, slightly oblique, articular margin, which is not quite smooth. Toward the upper part the shaft is finely and obliquely striated. The terminal piece is of considerable length, bluntly pointed inferiorly, where the membranous attachment fixes it, and slightly narrowed distally, the tip being curved like a hook, and a secondary process appearing beneath. The nearest, perhaps, is the bristle of *Stylerioides arcuosa*, though it also approaches the outline of several of the Sigalionidæ.

This species was introduced by the elder Sars* in 1835 under the name of *Nais clavicornis*. He describes it as half an inch in length and as having thirty-six segments in its rounded body, which was slightly tapered anteriorly and more distinctly posteriorly. The head has two eyes and a pair of tentacles, whilst the succeeding region has four pairs. The surface of the body is densely papillose, and a series of tufts of long bristles flank the sides. Posteriorly, moreover, peculiar jointed hook-like bristles occur. The capillary bristles were shorter in front, attained considerable length about the sixth and eighth feet, and then diminished in length posteriorly. He procured it near Floröen.

Grube, in his 'Familien der Anneliden'† (1851), gave the *Nais clavicornis* of Sars the generic title of *Macrocheta*, and placed it in his family Amytida in a heterogeneous assemblage, including *Polybostrychus*, Örsted, *Amytis*, Savigny, *Polynice*, Savigny, *Plectocharis*, Ehrenberg, and others.

Langerhaus‡ (1880) included *M. clavicornis*, which he had not infrequently found at Madeira, under the Cirra-

* 'Beskrivelser og Jagttagelser,' p. 64, pl. ix. fig. 24, a-d.

† P. 64.

‡ Zeitschr. f. wiss. Zool. Bd. xxxiv. p. 95, Taf. i. fig. 7.

tulea rather than under the Syllids. It has capillary dorsal and jointed ventral bristles. The author alludes to its relationship with *Acrocirrus frontifilis* of Marion and Bobretzky. He characterizes the genus thus:—Cirratulids with lateral branchiæ in several anterior segments; a pair of antennæ on the head. Peristomium without appendages. His examples ranged from 0·75 to 1·0 cm. and had thirty-two segments. Head and first six segments with brown corpuseles in the skin, and the body covered with small papillæ. Head with a median process anteriorly, two clavate antennæ, and four eyes arranged in a curve from side to side, the larger being external. Segments 2 to 5 with long, slightly club-shaped branchiæ. Dorsal bristles begin on the fourth segment (of the body), and the ventral division has jointed hooks. Anal segment rounded, without appendages. Proboscis unarmed. Eggs brownish yellow.

Caullery and Mesnil* (1898), who received a specimen 0·60 mm. long, collected by Langerhaus, from Marenzeller, point out that the long bristles are spinose and much resemble the temporary bristles of the pelagic larvæ of Spionids and Sabellarians. They think it a pelagic animal and similar to the genera *Tharyx* and *Chaetozone*, and, further, as a fixed epitokous form. *Acrocirrus* (*A. frontifilis* and *A. validus*) present analogous features. On the other hand, *Ledon sexoculata*, Webster and Benedict, has in the dorsal division of each foot capillary bristles 0·60 mm. long; they point out the identity of the hooks with those of *Acrocirrus*.

Mr. Southern †, to whom I am indebted for an examination of the annelid, considers that its systematic affinities are at present not clearly recognized. He adds, "that the relation to the Syllidæ is very slight, whilst that to the Cirratulidæ is not so pronounced as Caullery and Mesnil maintain." He procured examples in Blacksod Bay in weeds from rock-pools, in Laminarian roots, and with weeds in 1–4 fathoms; and by the dredge in Clew Bay and Ballynakill Harbour in a few fathoms.

EXPLANATION OF THE PLATES.

PLATE I.

- Fig.* 1. Tube of *Cistenides hyperborea*, Malmgren. Enlarged.
Fig. 2. Portion of the same, still further enlarged, to show the grains, nineteen to twenty-two of which occur at the wider end.

* Annales Univ. Lyon, fasc. xxxix. p. 130.

† Proc. Roy. Irish Acad. vol. xxxi. no. 47, p. 120.

- Fig. 3. Tube of *Cystenides granulata*, L. Enlarged.
 Fig. 4. Portion of the wider end, which has about fourteen sand-grains in a transverse line. Enlarged.
 Fig. 5. Tenth foot of *Spio martinensis*, Mesnil. \times Zeiss, oc. 2, obj. A.
 Fig. 6. An imperfect twentieth foot, to show the arrangement of the bristles and hooks. \times oc. 2, obj. A.
 Fig. 7. *Sabellides borealis*, Sars, from the dorsum. Enlarged under a lens.
 Fig. 8. Lateral view of the same. Ditto.
 Fig. 9. Anterior hook. \times oc. 4, obj. F, with draw-tube.
 Fig. 10. Smaller form with slight variation. Ditto.
 Fig. 11. Posterior hook. Ditto.
 Fig. 12. *Laphania boeckii*, var. *hystricis*. Anterior hook. \times oc. 4, obj. F.

PLATE II.

- Fig. 1. Anterior bristle of *Sabellides borealis*, Sars. \times oc. 4, obj. D.
 Fig. 2. Longer anterior bristle of *Laphania boeckii*, var. *hystricis*. \times oc. 4, obj. D, + 2 in draw-tube.
 Fig. 3. Shorter bristle with broad tip. \times oc. 4, obj. D, with full draw-tube.
 Fig. 4. Hook of *Amphitrite* near *grayi*, Malmgren. \times oc. 4, obj. D, with draw-tube.
 Fig. 5. Hook of *Loimia gigantea*, Montagu, from S. England. \times oc. 4, obj. D.
 Fig. 6. Hook of *Loimia medusæ* from Naples. \times oc. 4, obj. D, with 2 in draw-tube.
 Fig. 7. Hook of *Cistenides hyperborea*, Malmgren. \times oc. 4, obj. F, with draw-tube.
 Fig. 8. Anterior bristle of *Lanassa nordenskiöldi*, Malmgren. \times oc. 4, obj. A.
 Fig. 9. Hook. \times oc. 4, obj. D.
 Fig. 10. Longer anterior bristle of *Artacana canadensis*. \times oc. 4, obj. D.
 Fig. 11. Shorter bristle. Ditto.

PLATE III.

- Fig. 1. Anterior bristle of *Amphitrite* near *grænländica*, Malmgren. \times oc. 2, obj. D.
 Fig. 2. Hook of *Amphitrite affinis*, Malmgren. \times oc. 2, obj. D.
 Fig. 3. Hook of *Artacana canadensis*. \times oc. 4, obj. F, with draw-tube.
 Fig. 4. Stout bristle ("hook") of *Amæa trilobata*, Sars. \times oc. 4, obj. D.
 Fig. 5. Outline of a softened example of *Macrocheta clavicornis*, Sars, from St. Andrews Bay (1863). Magnified.
 Fig. 6. Portion of the body-wall, to show the papillæ. \times oc. 4, obj. A.
 Fig. 7. Jointed hook-like bristle. \times oc. 4, obj. D.
 Fig. 8. Upper end of shaft of hook-like form, with fine striæ in a large example. \times oc. 4, obj. D.
 Fig. 9. Portion of a bristle, indicating its minutely spinous condition. \times oc. 4, obj. F, with draw-tube.

II.—Four new *Delias* and a new *Ornithoptera* from the Angi Lakes, Arfak Mountains, North New Guinea, coll. Messrs. Pratt & Sons. By J. J. JOICEY, F.L.S., and A. NOAKES, F.E.S.

[Plates IV.–VI.]

Delias nigropunctata, Joicey & Noakes. (Pl. IV.)

Fore wing : ground-colour white, with black apex reaching to cell, and narrow on the costa to thorax. Posterior wings : black border shading to black dusting to anal angle ; very similar to *heroni*, Kenrick.

Fore wing underside as above, with five yellow spots from apex to vein 5.

Posterior wing underside : ground-colour blackish, fringed white, six deep black marginal spots, double black patch in cell, and three from the cell to the anal angle, yellow spot on a white ground at the base.

Two ♂ ♂ in the Joicey Coll.

Delias fuliginosus, ab. ♀ *ochraceus*, Joicey & Noakes. 826
(Pl. IV.)

Fore wings : ground-colour yellow dusted with black, apex black with five yellow spots. Posterior wings light yellow, darker near the base ; submarginal band blackish with bright yellow streaks intercepting. Underside similar to type, *kenricki*, which has black fore wings, whereas "*ochraceus*" differs by a wide discal yellow band.

Five ♀ ♀ in the Joicey Coll., one in Kenrick's collection.

Ornithoptera joiceyi, sp. n., Noakes & Talbot.
(Pls. IV. & V.)

This very distinct species is allied in general coloration to *goliath*, *titan*, and *supremus*, whilst in certain characters it shows relationship to *rothschildi*.

♂. *Upperside*.—Markings as in *supremus*, but on the fore wing the green is strongly tinged with gold. At the lower edge of the costal band, about midway between the base of vein 6 and distal margin, there projects a short spur. The first two spots of the discal patch, which are situate in cellules 4 and 3, are smaller than in *supremus*, being more invaded proximally by the black ground-colour. Some scattered scales in cellule 5 connect the first spot of the discal patch with the spur of the costal patch. Hind wing : the distal margin is more rounded than in the allied forms and the wing a little smaller ; there is a tendency for the

abdominal fold to be narrower. The black discal margin is as narrow as in *titan*, the markings on its proximal edge, the spots in 4, 5, and 6, and the veins, are golden-green; there is some black powdering on the spots.

Underside.—As in *supremus*, but more golden. Fore wing: the spots in 2 and 3 are joined, forming a black bar; the spots in 3 and 4 are of about equal size. There is some gold scaling on the black inner margin below 1a. Hind wing: this exhibits more relationship to *rothschildi* in the presence of a black patch, where the abdominal fold appears to show through in 1c, about midway between base and distal margin; also in the shape of the præcostal cell, which is shorter and broader than in *supremus*, and in the shorter præcostal spur. The affinity with *rothschildi* is particularly observed in the abdomen, which bears large black lateral patches on each segment, extending ventrally on the joints.

♀. *Upperside*.—Fore wing: ground-colour black. A grey patch in cell near its end, four long grey-white patches between cell and apex in cellules 5–8, their proximal ends pointed; the distal ends of those in 7 and 8 are nebulous, of those in 5 and 6 well defined. The patch in 5 is almost cut in two by a square-shaped spot of the ground-colour. A small spot below in 4, two long spots in 3 close together, an oblong patch in 2, a small rounded spot below vein 2, a submarginal row of five spots, two in 16 and the others in 2–4. All the spots grey-white powdered with black scales.

Hind wing: basal half of wing to just beyond cell black; distal half golden, heavily scaled with black, paler near bases of cellules 3 and 4. About midway between cell and distal margin a series of seven rounded spots; the first in 1c is anteriorly joined to the black ground-colour. A narrow black distal margin.

Underside.—Fore wing as above. Hind wing as above, but the yellow distal half is not scaled with black. Abdomen yellow dusted with black, especially on the first three segments. Basal half of each segment laterally clothed with black hair, which becomes long and more extensive on the ventral surface. This peculiar character shows relationship with *rothschildi*.

Length of fore wing, ♂ 86 mm., ♀ 110 mm.

This species is on the whole smaller than *supremus*.

In the ♂ the intensity of the golden colour is variable, some being more green than others. In the ♀ the markings are variable, and in some specimens the spots are much reduced; the spot in cellule 5 of the subapical patch is less

variable than others. On the hind wing the golden colour varies to grey-white, but is always more or less permanent in cellule 7 and at the distal margin. On the abdomen the extent of black hair is also variable.

The length of fore wing ranges from 64 mm. to 92 mm. in the ♂, and from 91 mm. to 110 mm. in the ♀.

Types: a ♂ and a ♀ from Angi Lakes, Arfak Mountains, 6000 ft., Dutch New Guinea, Jan.-Feb., 1914, collected by Messrs. A. C. and F. Pratt. A series from the same locality during March 1914.

Delias heroni, var. *albo-oculatus*, sp. n. (Pl. VI. fig. 1.)

The ♂ upperside is similar to *heroni*, Ken., except that the black margin is slightly wider on the hind wing, the black spot at the end of cell underneath showing quite plainly on the upperside.

Underside.—Front wings as in *heroni*. Lower wings: ground-colour white, very narrow black border widening at the abdomen, the yellow costal patch at base larger than in *heroni*, edged with black, the spot on centre deep black; anal angle, two round yellow spots and two long ones.

♀ (Pl. VI. fig. 2).—Markings the same as ♂, the black being less deep and slightly more extended and the ground-colour cream.

Six ♀ ♀ and a quantity of ♂ ♂.

Delias caroli, ab. *flava*. (Pl. VI. fig. 3.)

♂. *Upperside*.—Similar to *caroli*, Ken., except that there is a yellow patch showing on the margin of hind wing.

Underside.—Top wing the same as *caroli*. Lower wing: instead of red, as in *caroli*, there is a bright yellow row of marginal spots, also there are two small yellow spots at the anal angle.

The following four *Delias* are ♀ ♀ of described ♂ ♂, and the description of the ♀ ♀ may be of use to collectors. The collections of Rothschild, Kenrick, and Baker, we believe, all contain the ♀ ♀; the ♂ ♂ are figured in the Ann. & Mag. Nat. Hist. ser. 8, vol. iv. no. 21, pls. vi. & vii. (1909):—

D. heroni, ♀ (Pl. VI. fig. 4).—Almost the same as Kenrick's ♂, except that the black of the ♀ is much duller and more diffused and the ground-colour is cream, instead of white as in the ♂ ♂, with three yellow spots in the apex.

D. dixeyi, ♀ (Pl. VI. fig. 5).—Both upper and under

wings are similar to the ♂. The apical patch is cut more square than the ♂, with two small yellow apical spots; ground-colour light yellow. Lower wing: ground-colour deep yellow, showing the black of reverse side through, giving it a bluish appearance.

Underside of hind wing: the large round central spot deep yellow, the abdominal fold dotted with yellow.

D. bothwelli, ♀ (Pl. VI. fig. 6).—Similar to the ♂; the black of fore wing encircles the white slightly more than in the ♂, two yellow spots at the apex. Lower wing: ground-colour cream; black border from the top shading off to the middle, from there to the anal angle dusky blue, showing the underside red, streak through. Underside of lower wing light yellow; abdominal fold deep yellow, very like the ♂ ♂.

D. jordani, ♀ (Pl. VI. fig. 7).—Closely resembles the ♂, but the black apical patch is slightly larger and more defined than in the ♂. Lower wings cream with black margin, slightly wider than the ♂, and all the reverse markings showing through; three dull apical yellow spots. Underside of fore wing the same as in the ♂; underside only differs in the ♀ by the black spur in the middle of wing being shorter, leaving a more defined white discal band.

EXPLANATION OF PLATE VI.

- Fig. 1. Delias heroni*, var. *albo-oculatus*, ♂.
Fig. 2. " ", " *flava*, ♀.
Fig. 3. " caroli, ab. *flava*, ♂.
Fig. 4. " heroni, ♀.
Fig. 5. " dixeyi, ♀.
Fig. 6. " bothwelli, ♀.
Fig. 7. " jordani, ♀.

III.—Notes on *Fossorial Hymenoptera*.—XV.

By ROWLAND E. TURNER, F.Z.S., F.E.S.

New Australian Crabronidæ.

THE material for the present paper was partly collected by myself on a recent expedition to Tasmania and Australia. I am also indebted to Dr. Hamlyn-Harris, of the Queensland Museum, and Mr. Lea, of the South-Australian Museum, for the supply of specimens, several of which have proved to be novelties.

Key to the Australian Genera of the Ampulicinae.

- Front produced into a lamella projecting between the antennæ; second and third cubital cells each receiving a recurrent nervure; cubitus of the hind wing originating before the transverse median nervure *Dolichurus*, Ltr.
- Front without a lamella; first and third cubital cells each receiving a recurrent nervure, sometimes the second recurrent interstitial with the second transverse cubital nervure; cubitus of hind wing interstitial with the transverse median nervure *Aphelotoma*, Westw.

Dolichurus carbonarius, Sm.

Dolichurus carbonarius, Sm. Trans. Ent. Soc. London, p. 303 (1869). ♀.

Hab. Champion Bay, W.A. (*du Boulay*); Mackay, Q. (*Turner*); January. Kuranda, Q. (*Turner*); May to July.

This seems to be the only Australian species of the genus. I took it in considerable numbers at Kuranda in 1913; the males, which were much the commonest, running on foliage, the females most often in loose bark at the foot of large trees.

Key to the Species of Aphelotoma.

♀ ♀.

1. Legs wholly bright ferruginous *A. tasmanica*, Westw.
 Legs black, sometimes partly fusco-ferruginous 2.
2. Second recurrent nervure received by the third cubital cell 3.
 Second recurrent nervure interstitial with the second transverse cubital nervure 4.
3. Clypeus and antennæ black *A. striaticollis*, Turn.
 Clypeus and six basal joints of antennæ pale ferruginous *A. affinis*, Turn.
4. Pronotum rugose; dorsal segments 3-5 covered with short golden pubescence .. *A. auriventris*, Turn.
 Pronotum almost smooth, opaque; dorsal segments shining, without conspicuous pubescence *A. aterrima*, Turn.

♂ ♂.

1. Abdomen bright ferruginous red *A. rufiventris*, Turn.
 Abdomen black, sometimes with bronze sheen. 2.
2. Pronotum rugose, with a small spine on each side at the anterior angles 3.
 Pronotum almost smooth, without a spine at the anterior angles *A. aterrima*, Turn.
3. Femora black; third dorsal segment covered with golden pubescence *A. auriventris*, Turn.
 Femora bright ferruginous; third dorsal segment without pubescence *A. tasmanica*, Westw.

Aphelotoma tasmanica, Westw.

Aphelotoma tasmanica, Westw. Trans. Ent. Soc. Lond., Journ. of Proc. p. 13 (1840). ♀.

Hab. Tasman's Arch ; February. Eaglehawk Neck ; March. Victoria.

Taken running on dead *Eucalyptus*-logs in which old beetle-holes were numerous. Although of considerably smaller size, this wasp bears a considerable resemblance to ants of the genus *Myrmecia*, especially *M. esuriens*, Fabr., and another species with red legs, *Myrmecia pilosula*, Sm. When alarmed the wasp often picks up a fragment of dead stick or leaf, which it carries in its mandibles, thus increasing the resemblance to the ant. *Aphelotoma auriventris*, Turn., a species with a wide range in the southern half of Australia, also bears a considerable likeness to *Myrmecia mandibularis*, Sm., though the difference in size is very great ; I have never seen this species or any of the Queensland species of *Aphelotoma* carrying anything in their mandibles. The Tasmanian species is considerably larger than any other of the genus.

I have not seen males from Tasmania or females from Victoria, and it is possible that the Victorian males belong to a different species, the pronotum being more coarsely rugose and the first recurrent nervure interstitial with the first transverse cubital nervure.

Aphelotoma auriventris, Turn.

Aphelotoma auriventris, Turn. Ann. & Mag. Nat. Hist. (7) xix. p. 269 (1907).

Hab. Grampian Hills, Victoria ; Kangaroo Island, S.A. ; Yallingup, S.W. Australia.

Aphelotoma affinis, Turn.

Aphelotoma affinis, Turn. Proc. Zool. Soc. London, p. 341 (1910). ♀.

This is nearer to *striaticollis* than to any other species, but may be distinguished by the colour of the clypeus and antennæ and by the somewhat finer sculpture of the pronotum and median segment. It is possible that it may prove to be a variety of that species.

Subfamily *SPHECINÆ*.*Chlorion (Proterospheæ) rhodosoma*, sp. n.

♀. Rufo-ferruginea; capite nigro, argenteo-piloso, clypeo, scapo flagelloque articulo primo rufo-ferrugineis; alis flavo-hyalinis, apice late infuscatis, venis basi ferrugineis, apice fuscis.

Long. 18-20 mm.

♀. Clypeus very feebly convex, longer than broad, with a small shallow emargination in the middle of the apical margin, the angles of the emargination produced into short blunt teeth. Inner margins of the eyes converging slightly towards the clypeus. Second joint of the flagellum nearly twice as long as the third, the first and second combined about equal in length to the third and fourth. Scutellum and postscutellum flat, without sulci or tubercles; median segment with a shallow median sulcus, transversely rugose-striate, the transverse ridges not very distinct and irregular, numbering ten or twelve. Petiole about equal in length to the second joint of the hind tarsus. Basal joint of the fore tarsi with a comb of six long spines.

Hab. Cue, Western Australia (*Brown*); Cunderdin, S.W. Australia (*Mrs. Lundy*).

This is very nearly related to *rugifer*, Kohl, but differs conspicuously in the colour of the thorax, legs, and wings. In *rugifer* there are more spines on the basal joint of the fore tarsi, the transverse ridges on the median segment are fewer, and there seems to be some difference in the length of the antennal joints and petiole.

It is quite possible that both this and *C. darwiniensis*, Turn., are both local forms of *rugifer*. *C. darwiniensis* has the thorax and median segment black as in *rugifer*, but the legs are red, the third abscissa of the radius is shorter than in *rhodosoma*, there is a distinct sulcus on the scutellum, and the petiole is a little shorter.

Chlorion (Proterospheæ) basilicus, sp. n.

♀. Nigra; tegulis, femoribus, tibiis tarsisque brunneo-rufis; alis flavo-hyalinis, apice late infumatis; capite, thorace segmentoque mediano dense aureo-pubescentibus.

Long. 36 mm.

♀. Clypeus convex, with a very fine median carina, second joint of the flagellum nearly as long as the third and fourth combined. Scutellum and postscutellum divided by a longitudinal sulcus, which is deeper on the scutellum than on

the postscutellum. Head, thorax, and median segment covered with dense golden pubescence, which becomes thin on the vertex, the disc of the mesonotum, and the scutellum. Petiole as long as the third joint of the hind tarsus. Basal joint of the fore tarsi with nine long spines. Third abscissa of the radius scarcely more than half as long as the first. Scutellum convex.

Hab. N. Queensland, probably from the Cape York Peninsula.

Allied to *vestitus*, Sm., but may be easily distinguished by the colour of the legs and by the much greater size, in which points it approaches *staudingeri*, Grib., from New Guinea.

Subfamily *PHILANTHINÆ*.

Cerceris calida, sp. n.

♀. Flava; capite fascia lata inter oculos, antice utrinque ad antennarum basin producta, mesonoto fasciis tribus longitudinalibus, segmento mediano area basali linea angusta basali lineaque longitudinali mediana, segmentis dorsalibus tertio quartoque basi in medio late, quintoque basi anguste nigris; petiolo fascia lata longitudinali, segmento secundo macula basali flava, area pygidiali pedibusque posticis pallide ferrugineis; alis hyalinis, cellula radiali infuscata, venis ferrugineis; flagello pallide ochraceo.

♂. Feminae similis, segmento mediano area basali tota nigra. Long., ♀ 7, ♂ 6 mm.

♀. Clypeus with the median lobe broader at the base than long, narrowed towards the apex, slightly porrect at the apex, the margin broadly and shallowly emarginate. Antennæ inserted nearly half as far again from the anterior ocellus as from the base of the clypeus, the frontal carina short, but high and pointed between the antennæ; second joint of the flagellum distinctly longer than the third; mesopleuræ without spines or tubercles; basal area of the median segment smooth, with a longitudinal sulcus and a few large punctures at the extreme base and on the sides; postscutellum smooth; the head, thorax, and abdomen coarsely and closely punctured. Petiole longer than broad, distinctly broader at the base than at the apex; pygidial area elongate-ovate, narrowly truncate at the apex.

♂. Petiole nearly twice as long as the breadth at the base; median lobe of the clypeus longer than broad.

Hab. Kuranda, N. Queensland; May.

This is nearest to *prædura*, Turn., but, in addition to the

great difference in colour, the slightly porrect clypeus, the slightly broader pygidial area, and the shorter petiole are quite sufficient distinctions.

Subfamily *ARPACTINÆ*.

Key to the Genera of the Arpactinæ.

1. Cubitus of hind wing originating before the transverse median nervure; antennæ clavate; hind tarsi very long *Ammatomus*, Costa.
- Cubitus of hind wing originating beyond the transverse median nervure; antennæ not clavate; hind tarsi not unusually long 2.
2. First recurrent nervure received close to the apex of the first cubital cell; second near the apex of the second cubital cell *Miscothyris*, Sm.
- Both recurrent nervures received by the second cubital cell *Arpactus*, Jur.

Key to the Australian Species of Ammatomus.

♀ ♀.

- Second dorsal segment ferruginous, with a yellow band on the apical margin *A. decoratus*, Handl.
(= *ornatus*, Sm.).
- Second dorsal segment wholly black *A. icarioides*, Turn.

Genus *MISCOTHYRIS*, Sm.

Miscothyris, Sm. Trans. Ent. Soc. London, p. 307 (1869).

Clytemnestra, Spin. Gay. Hist. fis. Chile, vi. p. 341 (1851) (nec Dana).

Clytemnestra having been used by Dana for Crustacea in 1847, it cannot be used here.

I cannot see that Smith's genus is distinct from Spinola's, the tubercle on the second ventral segment of the male being almost the only good character for separation. The statement of Ashmead that the anterior tarsi in the female of *Miscothyris* are without a comb is entirely erroneous. As I understand the genus, it would include Handlirsch's groups *bipunctatus*, *chilensis*, and *thoracicus*. The type of *Clytemnestra* is *gayi*, Spin. The genus is only represented in America and Australia. Handlirsch includes it in *Gorytes* in his revision of that genus, but I think it is more convenient to treat it as a separate genus.

I have not seen *M. megalophthalmus*, Handl., but, according to Handlirsch, both recurrent nervures are received by the second cubital cell, though in other points it is nearly

related to *thoracicus*, Sm. The male only is described, and the locality given "Australia."

Key to the Australian Species of Miscothyris.

♀ ♀.

1. Second joint of flagellum slender, more than twice as long as the third; abdomen black, banded with orange; hind tibiæ swollen and strongly serrate *M. thoracicus*, Sm.
 Second joint of flagellum not slender, never more than half as long again as the third; abdomen not marked with orange; hind tibiæ not swollen 2.
2. Hind tibiæ serrate; abdomen ferruginous, with an obscure yellow spot on each side of the second segment *M. sanguinolentus*, Turn.
 Hind tibiæ spinose; abdomen more or less black 3.
3. Pronotum and fourth dorsal segment entirely black, scutellum wholly yellow; second joint of flagellum almost equal to the third *M. lucidulus*, Turn.
 Pronotum and fourth dorsal segment with yellow bands, scutellum mostly black; second joint of the flagellum nearly half as long again as the third *M. duboulayi*, Turn.

Miscothyris duboulayi, Turn.

Gorytes duboulayi, Turn. Proc. Zool. Soc. London, p. 496 (1908). ♀.

Clytemnestra duboulayi, Turn. Ann. & Mag. Nat. Hist. (8) x. p. 58 (1912).

Hab. N.W. Australia (*Du Boulay*). Probably from Nicol Bay.

A variety from Rutherglen, Victoria, is distinguished by the entire absence of the ferruginous colour on the abdomen and by the black femora. The yellow markings on the abdomen are the same as in the type, but the yellow band on the fourth dorsal segment is continuous. This species may be distinguished from *lucidulus*, Turn., by the longer second joint of the flagellum, which is nearly half as long again as the third, not nearly equal as in *lucidulus*, and by the much smaller facets of the eyes in front. The distribution of the yellow markings is also very different.

Key to the Australian Species of Arpactus.

♀ ♀.

1. Eyes not convergent towards the clypeus 2.
- Eyes strongly convergent towards the clypeus 4.

- | | |
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| 2. First abdominal segment not constricted at the apex | 3. |
| First abdominal segment constricted at the apex | <i>A. secernendus</i> , Turn. |
| 3. Second ventral segment angular at the base; black, the second abdominal segment red | <i>A. rubrosignatus</i> , Turn. |
| Second ventral segment not angular at the base; otherwise coloured | <i>A. rufomixtus</i> , Turn. |
| 4. Basal area of median segment smooth .. | 5. |
| Basal area of median segment coarsely striated | 6. |
| 5. Basal half of second dorsal segment orange | <i>A. ciliatus</i> , Handl. |
| Second dorsal segment wholly black.... | <i>A. perkinsi</i> , Turn. |
| 6. Second dorsal segment marked with orange or yellow | 7. |
| Second dorsal segment wholly black .. | 8. |
| 7. Three basal dorsal segments broadly banded with orange at the apex | <i>A. tarsatus</i> , Sm. |
| Three basal dorsal segments with interrupted yellow bands at the apex | <i>A. obesus</i> , Turn. |
| 8. Scutellum, postscutellum, and bands of the abdomen bright orange | <i>A. chrysozonus</i> , Turn. |
| Scutellum and postscutellum black; bands of the abdomen yellow and narrower | <i>A. bellicosus</i> , Sm. |

♂ ♂,

- | | |
|--|-------------------------------|
| 1. Basal area of the median segment smooth | <i>A. ciliatus</i> , Hand, |
| Basal area of the median segment striated | 2. |
| 2. The two subapical joints of the flagellum at least more or less arched beneath, and subtuberculate or spinose at the apical angles; ventral segments 4-6 without long ciliæ | 3. |
| The two subapical joints of the flagellum not arched or subtuberculate beneath; ventral segments 4-6 usually with long ciliæ | 5. |
| 3. Apical joint of the flagellum with a spine at the base; abdomen black with yellow bands, first segment broad | 4. |
| Apical joint of the antennæ without a spine; abdomen with the two basal segments mostly orange; first segment narrow | <i>A. spinicornis</i> , Turn. |
| 4. Abdominal fasciæ continuous, and on the five basal segments | <i>A. spryi</i> , Turn. |
| Abdominal fasciæ broadly interrupted, and on the three basal segments only.. | <i>A. obesus</i> , Turn. |
| 5. Scutellum more or less longitudinally striated | 6. |
| Scutellum almost smooth | 8. |

- | | |
|--|-------------------------------|
| 6. Second dorsal segment entirely black .. | <i>A. bellicosus</i> , Sm. |
| Second dorsal segment banded with orange or yellow | 7. |
| 7. Three basal dorsal segments with broad orange fasciæ; mesonotum coarsely punctured-rugose | <i>A. tarsatus</i> , Sm. |
| Basal dorsal segment ferruginous, second with an interrupted yellow fascia; mesonotum sparsely punctured | <i>A. pretiosus</i> , Turn. |
| 8. Abdominal segments, except the third, with narrow yellow apical fasciæ | 9. |
| Abdominal segments with broad orange fasciæ or almost entirely orange | 10. |
| 9. Flagellum black | <i>A. frenchii</i> , Turn. |
| Flagellum ferruginous | <i>A. consuetipes</i> , Turn. |
| 10. Postscutellum longitudinally striated; ventral segments 4-6 without ciliæ of long hairs | <i>A. cygnorum</i> , Turn. |
| Postscutellum punctured; ventral segments 4-6 with ciliæ of long hairs | <i>A. aurantiacus</i> , Turn. |

Mr. Durrant has pointed out to me that the name *Arpactus*, Jur., has priority for the genus over *Gorytes*, Latr., which must sink as a synonym.

Arpactus bellicosus, Sm.

Gorytes bellicosus, Sm. Trans. Ent. Soc. London, (3) i. 2, p. 55 (1862). ♀.

Gorytes dizonus, Handl. Sitzber. Akad. Wiss. Wien, civ. p. 873 (1895). ♂.

I have no doubt that these are identical, as Handlirsch suggests.

In addition to this species and *ciliatus*, Handl., the four following species may be included in the group:—

1. *Arpactus frenchii*, Turn.

Gorytes frenchii, Turn. Proc. Zool. Soc. Lond. p. 501 (1908). ♂.

This differs from Handlirsch's characters in not having the apical joint of the flagellum curved. The fourth and fifth ventral segments have ciliæ of long hairs near the apex. The fore tarsi have a few short but distinct spines; intermediate tibiæ with two strong apical spines. This species is nearer to *bellicosus* than to *ciliatus*. The type is from Victoria, but I have seen a specimen taken near Sydney.

In *bellicosus* the yellow apical bands are on the first and third segments, not on the second; in *frenchii* on the first and second, not on the third.

2. *Arpactus perkinsi*, Turn.

Gorytes perkinsi, Turn. Ann. & Mag. Nat. Hist. (8) x. p. 57 (1912). ♀.

As noticed in the description, this is near *ciliatus*, but there is no orange on the second dorsal segment and much more on the third. There are two strong spines at the apex of the intermediate tibiæ.

3. *Arpactus tarsatus*, Sm.

Gorytes tarsatus, Sm. Cat. Hym. B.M. iv. p. 366 (1856). ♂.

Gorytes eximius, Sm. Trans. Ent. Soc. London, (3) i. p. 65 (1862). ♀.

As Handlirsch points out, these are undoubtedly sexes of one species. The ciliæ on the fourth and fifth ventral segments are well developed; the apical joint of the antennæ is curved; fore tarsi not ciliated; intermediate tibiæ with one long apical spur, the second spur more slender and not more than half as long.

4. *Arpactus cygnorum*, Turn.

Gorytes cygnorum, Turn. Proc. Zool. Soc. London, p. 500 (1908). ♂.

The apical joint of the antennæ is not curved; fore tarsi not ciliate; intermediate tibiæ with one long apical spine, the second spine very short and slender; hind tibiæ with a few spines on the outer margin. The ciliæ on the ventral segments are not present in this species, possibly the long hairs may have been rubbed off.

In other points the species agrees well with the characters of the group, and is undoubtedly closely related to the other species.

Arpactus aurantiacus, sp. n.

♂. Niger; clypeo, antennis, genis, pronoto, callis humeralibus, lateribus dorsuli, mesopleuris antice, tegulis, scutello, post-scutello, segmento mediano, lateribus et linea mediana nigris, abdomine, segmento primo dorsali apice anguste tertioque dimidio basali nigris, pedibusque aurantiacis; alis flavo-hyalinis, venis ferrugineis,

Long. 17 mm,

♂. Eyes convergent towards the clypeus, separated at the base of the antennæ by a distance equal to the length of the second joint of the flagellum, which is about half as long again as the third; apical joints of the flagellum missing. Posterior ocelli more than half as far again from each other as from the eyes; front slightly concave, a longitudinal

sulcus reaching the anterior ocellus. Head and thorax rather sparsely punctured; mesopleuræ very sparsely punctured, the sternal carina not well defined as in other species of the *ciliatus* group; the transverse groove at the base of the scutellum foveolate, but narrow and ill defined in the middle; basal area of the median segment very finely and closely obliquely striated, divided by a deep longitudinal sulcus, the sides of the segment coarsely punctured-rugose. First abdominal segment short and not very strongly narrowed to the base, ventral segments 4-6 with ciliæ of long fulvous hairs, seventh dorsal segment not very small, very broadly rounded at the apex. Fore tarsi distinctly ciliated, intermediate tibiæ with two strong apical spines, hind tibiæ spinose. Second abscissa of the radius very short, about one-tenth of the length of the third; first transverse cubital nervure sharply bent outwards near the cubitus, emitting from the bend a scar which reaches to the base of the stigma; both recurrent nervures received by the second cubital cell; cubitus of hind wing interstitial with the transverse median nervure.

Hab. Ankertell, W. Australia (*Brown*).

Type from South Australian Museum.

In most points this fine species closely resembles *ciliatus*, but differs in the position of the cubitus of the hind wing, which is interstitial; in *ciliatus* and *perkinsi*, however, the cubitus is much nearer to the transverse median nervure than in *bellicosus* and other species of the group. Other structural points distinguishing this species from *ciliatus* are the lesser development of the sternal carina, the sculpture of the enclosed area of the median segment, and the much greater development of the second spine of the intermediate tibiæ. I have only seen the female of *ciliatus* in which both of these spines are developed, but Handlirsch could only see one well-developed spine in the male, and in several species of the group the second spine is much reduced or almost obsolete in the male.

Arpactus chrysozonus, sp. n.

♀. Nigra; clypeo, scapo flagelloque articulo primo flavis; pronoto postice, callis humeralibus, tegulis, mesonoto angulis posticis, scutello, postscutello macula magna transversa, segmento dorsali primo dimidio apicali, tertio quartoque fascia lata apicali, segmento sexto, femoribus apice, tibiis tarsisque aurantiacis; alis hyalinis, area costali late infuscata, venis nigris.

Long. 13 mm.

♀. Eyes converging towards the clypeus, separated at

the base of the antennæ by a distance nearly equal to twice the length of the scape, third joint of the flagellum almost equal to the second. Posterior ocelli as far from the eyes as from each other. Head and thorax very finely and closely punctured, mesopleuræ horizontally striated on the upper portion, finely punctured on the lower portion, the carinæ as in *ciliatus*; the transverse groove at the base of the scutellum foveolate, but very narrow and indistinct in the middle. Median segment coarsely longitudinally striated, less coarsely on the basal area than elsewhere. Abdomen very finely punctured, the basal segment short, about half as broad at the apex as the second segment; pygidial area elongate-triangular, very narrowly truncate at the apex. Fore tarsi very strongly ciliate, the apical joint much swollen, the pulvilli large; hind tibiæ spinose; intermediate tibiæ with two strong apical spines, the one much longer than the other. Second abscissa of the radius very short, not more than one-eighth of the length of the third, cubitus of the hind wing originating at a distance beyond the transverse median nervure slightly exceeding the length of that nervure.

Hab. Brisbane (*Hacker*); October. From the Queensland Museum.

This is closely allied to *perkinsi* and *ciliatus*, but the sculpture of the median segment is very different.

Arpactus spryi, sp. n.

♂. Niger; scapo, flagello articulo primo, pronoto postice, callis humeralibus, segmentis dorsalibus 1-5 linea transversa apicali, femoribus anticis apice subtus, tibiisque anticis et intermediis macula basali flavis; tegulis, femoribus apice, tibiis tarsisque ferrugineis; alis hyalinis, venis fuscis.

Long. 9 mm.

♂. Clypeus broadly truncate at the apex; eyes strongly convergent towards the clypeus, separated at the base of the antennæ by a distance about half as great again as the length of the scape; posterior ocelli much farther from each other than from the eyes. Apical joint of the flagellum very strongly curved, with a small spine at the base, scarcely longer than the penultimate; joints 8-11 slightly produced at the apical angle, but not sufficiently to form a spine. Pronotum narrow and transverse; mesopleuræ with a distinct vertical carina in front, the mesosternum separated from the mesopleuræ by a carina, the upper part of the mesopleuræ horizontally striated, the lower part rugulose.

Mesonotum shallowly punctured; a distinct foveolate transverse groove at the base of the scutellum. Scutellum and postscutellum closely longitudinally striated; basal area of median segment strongly obliquely striated, the sides of the segment coarsely rugose. Abdomen narrowed at the base, the first segment about half as broad at the apex as the second, seventh dorsal segment small, broadly rounded at the apex; second ventral segment not angular at the base. Ventral segments without cilia or long hairs. Fore tarsi not ciliated, intermediate tibiae with one long apical spine, the second spine very short and slender, hind tibiae feebly serrate. Second abscissa of the radius very short, about one quarter of the length of the third, first transverse cubital nervure bent sharply outwards near the cubitus and emitting inwards a short spurious vein, both recurrent nervures received by the second cubital cell far apart. Cubitus of the hind wing originating at a distance beyond the transverse median nervure about half as great again as the length of that nervure.

Hab. Mordialloc, Victoria (*Spry*).

This belongs to the *ciliatus* group, differing from most species of that group in the structure of the antennae and in the absence of long cilia on the ventral segments.

Arpactus obesus, sp. n.

♂. Niger; scapo subtus, pronoto linea utrinque; segmentis dorsalibus primo tertioque fasciis apicalibus interruptis, secundo macula apicali utrinque, femoribus anticis subtus, tibiis anticis, tibiis intermediis et posticis basi, tarsis anticis, tarsisque intermediis et posticis articulis 4 basalibus dimidio basali flavis; alis hyalinis, venis fuscis.

♀. Mari similis; segmentis dorsalibus tertio quartoque fascia continua apicali, quinto macula parva flavis; flagello subtus fusco-ferrugineo.

Long., ♂ 7 mm., ♀ 8 mm.

♂. Eyes convergent towards the clypeus, separated at the base of the antennae by a distance more than half as great again as the length of the scape; apical joint of the flagellum strongly curved, no longer than the penultimate, which is subtuberculate at the base. Posterior ocelli nearly twice as far from each other as from the eyes; a small tubercle between the antennae; a shallow frontal sulcus reaching the anterior ocellus. Head and thorax punctured, the groove at the base of the scutellum foveolate; postscutellum longitudinally, basal area of the median segment

obliquely striated, dorsal surface of the median segment coarsely obliquely striated at the sides, not distinctly margined; mesopleuræ horizontally striated on the upper, obliquely on the lower portion. First abdominal segment short and broad, fully half as broad at the apex as the second segment, ventral segments without ciliæ. Fore tarsi not ciliate, intermediate tibiæ with two apical spines, one distinctly longer than the other, hind tibiæ feebly serrate at the apex. Neuration as in *spryi*, but the second abscissa of the radius is very short, not more than one-eighth of the length of the third.

♀. Second ventral segment not angular at the base; pygidial area elongate-triangular. Apical joint of fore tarsi very large and stout as in most females of the group.

Hab. Yallingup, S.W. Australia; December.

This is nearest to *spryi*, but differs in the lesser development of the characters of the apical joints of the flagellum, in the tubercle between the antennæ, in the sculpture of the scutellum, and in the colour of the legs and abdomen. The second cubital cell is also shorter on the radius in the present species.

Arpactus pretiosus, sp. n.

♂. Niger; clypeo, scapo subtus, segmento dorsali secundo fasciæ apicali in medio anguste interrupta, femoribus anticis subtus tibiisque anticis supra flavis; tarsis intermediis et posticis flavo-maculatis; scapo subtus, segmento abdominali primo, tegulis, tibiis intermediis et posticis basi tarsisque ferrugineis; alis hyalinis, venis fuscis.

Long. 7.5 mm.

♂. Eyes convergent towards the clypeus, separated at the base of the antennæ by a distance nearly half as great again as the length of the scape; apical joint of the flagellum distinctly but not strongly curved, a little longer than the penultimate. Head and thorax punctured; a frontal sulcus reaching the anterior ocellus; the suture at the base of the scutellum foveolate; mesopleuræ horizontally striated on the upper part, obliquely rugose-striate on the lower, the carinæ as in *ciliatus*. Scutellum finely longitudinally rugose-striate; postscutellum and basal area of the median segment more coarsely longitudinally striated; dorsal surface of the median segment coarsely reticulate at the sides and distinctly margined. Abdomen very finely and closely punctured, the first segment short, fully half as broad at the apex as the second segment; the ciliæ at the apex of the fourth and fifth ventral segments

long. Fore tarsi not ciliated; intermediate tibiæ with only one distinct apical spine; hind tibiæ serrate. Neurulation as in *spryi*, but the second abscissa of the radius is a little longer, and the branch from the first transverse cubital nervure is only faintly indicated.

Hab. Yallingup, S.W. Australia; January.

One male only taken.

This is another species of the *ciliatus* group.

Arpactus spinicornis, sp. n.

♂. Niger; clypeo, scapo, flagello articulo primo, pronoto linea transversa, callis humeralibus, tegulis, segmentis dorsalibus primo secundoque, secundo macula magna nigra, pedibusque aurantiacis; flagello articulis 2-11 dimidio apicali subtus albis; alis subhyalinis, venis nigris.

Long. 10 mm.

♂. Eyes convergent towards the clypeus, separated at the base of the antennæ by a distance greater than the length of the scape; second joint of the flagellum distinctly longer than the third, apical joints strongly curved, a little longer than the penultimate, the tenth and eleventh joints strongly produced at the apex beneath into blunt tubercles, the four preceding joints similarly but much less strongly produced; posterior ocelli nearly twice as far from each other as from the eyes. Head and thorax finely and rather sparsely punctured; the transverse groove at the base of the scutellum distinct and foveolate, scutellum and post-scutellum strongly longitudinally striated; basal area of median segment strongly obliquely striated, the remainder of the median segment coarsely rugose; mesopleuræ finely obliquely striated on the lower portion, more strongly horizontally striated on the upper portion, the vertical carina and sternal horizontal carina distinct as in *ciliatus*. First abdominal segment much narrowed to the base, as long as the second segment, less than half as wide at the apex as the second segment; abdomen sparsely punctured, ventral segments without long ciliæ, seventh dorsal segment rounded. Neurulation as in *spryi*, but the cubitus of the hind wing is separated from the transverse median nervure by a distance equal to twice the length of that nervure. Fore tarsi not ciliated; only one spine at the apex of the intermediate tibiæ.

Hab. Beverley, S.W. Australia (*Du Boulay*).

Type from South Australian Museum.

The species belongs to the *ciliatus* group; but, as in some

of the other species of the group, the cilia of long hairs on the ventral segments is missing. The first abdominal segment is much longer and more slender than in any other species of the group except *consuetipes*. The antennal structure resembles *spryi*, but the peculiarities are rather more developed than in that species.

Arpactus consuetipes, sp. n.

♂. Niger; antennis, tegulis, femoribus apice, tibiis tarsisque ferrugineis; pronoto linea transversa, callis humeralibus, scutello macula parva, segmentisque abdominalibus primo, secundo, quarto quintoque fasciis angustis apicalibus flavis; segmentis duobus apicalibus pallide ferrugineis; alis hyalinis, venis ferrugineis. Long. 9 mm.

♂. Eyes very strongly convergent towards the clypeus, separated at the base of the antennæ by a distance not quite equal to the length of the scape. Apical joint of the flagellum longer than the penultimate, very feebly curved. Mesopleuræ horizontally striated on the upper portion. A transverse foveolate groove at the base of the scutellum; postscutellum and basal area of the median segment coarsely longitudinally striated, the dorsal surface of the median segment on the sides rugose, separated from the sides of the segment by distinct carinæ, the sides of the segment rugose-striate. First abdominal segment narrowed to the base, at the apex only one-third of the breadth of the apex of the second segment. Fourth and fifth ventral segments with distinct apical ciliæ. Fore tarsi not ciliated; intermediate tibiæ with two equal apical spines; hind tibiæ moderately spinose. The neurulation is similar to *spryi*, but the spurious vein branching from the first transverse cubital nervure is not clearly defined, and on one side the first transverse cubital nervure is incomplete, not reaching the radius.

Hab. New South Wales.

Received from Mr. C. French.

This belongs to the *ciliatus* group; the first abdominal segment is more slender than in other species of the group.

Arpactus rubrosignatus, sp. n.

♀. Nigra; segmento abdominali secundo rubro, apice anguste nigro; alis hyalinis, leviter infuscatis, venis nigris, stigmate ferrugineo.

Long. 10 mm.

♀. Eyes not convergent towards the clypeus, their inner

margins almost parallel. Antennæ rather long, the third joint of the flagellum a little longer than the second. Posterior ocelli farther from each other than from the eyes. Head and thorax very finely and closely punctured, the transverse groove at the base of the scutellum broad and foveolate. A distinct vertical carina from the prothoracic tubercles not quite reaching the sternum; mesopleuræ finely punctured. Basal area of the median segment well defined, with very strong longitudinal striæ; the sides of the dorsal surface irregularly and coarsely striated, the sides of the segment finely obliquely striated. First abdominal segment not at all constricted at the apex, the second segment not more than half as broad again at the apex as the first; second ventral segment angular at the base; abdomen opaque, very finely and closely punctured; pygidial area elongate, not very broad. Fore tarsi distinctly, but not strongly ciliated, hind tibiæ smooth. Third abscissa of the radius nearly half as long again as the second, both recurrent nervures received by the second cubital cell, first transverse cubital nervure not branched; cubitus of hind wing originating at a distance beyond the transverse median nervure not quite equal to the length of that nervure.

Hab. Between Yallingup and Busselton, S.W. Australia; September.

Except in the somewhat more strongly ciliated fore tarsi and the rather narrow pygidial area, this species does not differ appreciably in structure from the European *mystaceus*, Linn.

Arpactus secernendus, sp. n.

♀. Nigra; mandibulis, clypeo apice, antennis, pronoto linea transversa, callis humeralibus, tegulis, segmentis abdominalibus primo sextoque, pedibusque ferrugineis; segmentis 2-5 dorsalibus et ventralibus fascia apicali fusco-ochracea; alis hyalinis, venis ferrugineis.

Long. 9 mm.

♀. Eyes not converging towards the clypeus, antennæ inserted as far from each other as from the eyes, the second joint of the flagellum no longer than the third. Clypeus narrowly transversely depressed on the apical margin, posterior ocelli a little farther from each other than from the eyes. Head and thorax finely and closely punctured, a vertical carina from the pronotal tubercles not extending to the sternum; a deep foveolate groove at the base of the scutellum; basal area of the median segment smooth, with a

deep longitudinal sulcus, the rest of the segment coarsely and irregularly striated. Abdomen closely and minutely punctured; the first segment narrowed to the base and somewhat constricted at the apex, not quite half as broad at the apex as the second segment; third, fourth, and fifth segments clothed with fine yellowish hairs; pygidial area in the form of a slightly elongate triangle, shining and sparsely punctured. Fore tarsi rather feebly ciliated, hind tibiae smooth, pulvilli small. Second abscissa of the radius about one-third of the length of the third; first transverse cubital nervure sharply bent outwards near the cubitus, but not emitting a sear or nervure inwards; cubitus of hind wing separated from the transverse median nervure by a distance equal to about half the length of that nervure.

Hab. S.E. Australia.

This is near the *mystaceus* group in most characters, but differs in the form of the first abdominal segment and of the second ventral segment, which is not angular at the base. In these characters it also departs further from the group than *rubrosignatus*, to which in most structural points it is closely allied. *A. rufomixtus*, Turn., is nearest to this species, but differs in the form of the first abdominal segment.

Arpactus constrictus, Sm.

Gorytes constrictus, Sm. Journ. Proc. Linn. Soc. iii. p. 160 (1859). ♂ ♀.
? *Gorytes vagus*, Sm. l. c. p. 161 (1859). ♀.

Handlirsch considers from the descriptions that these are merely colour-varieties of one species. This is very probably correct, but I have not seen typical *constrictus*, which is from Aru. There is a female specimen of *vagus* from Ké in the British Museum. It belongs to the group *stenopygus*, Handl., having the pygidial area very narrow, otherwise agreeing well with the *mystaceus* group.

Subfamily NYSSONINÆ.

Key to the Australian Species of Nysson (Acanthostethus).

♂ ♂.

- | | |
|--|-------------------------------|
| 1. Seventh dorsal segment with more than two apical spines | 2. |
| Seventh dorsal segment with two apical spines only | 7. |
| 2. Seventh dorsal segment with a row of five acute apical spines | <i>N. nudiventris</i> , Turn. |

- Seventh dorsal segment with three apical spines 3.
3. Ventral segments 2-4 with an apical fringe of long hairs 4.
- Ventral segments without a fringe of long hairs *N. saussurei*, Handl.
4. Abdominal segments 3-6 with a spine on each side at the apical angles 5.
- Abdominal segments 3-6 without spines at the apical angles *N. mysticus*, Gerst.
5. Dorsal surface of median segment much shorter than scutellum; basal dorsal segment black *N. mærens*, Turn.
- Dorsal surface of median segment about as long as scutellum; basal dorsal segment ferruginous 6.
6. Basal area of median segment coarsely longitudinally striated; second recurrent nervure interstitial. Length 7 mm. *N. confertus*, Turn.
- Basal area of median segment finely obliquely striated; second recurrent nervure received before the first transverse cubital nervure. Length 4-5 mm. . . *N. minimus*, Turn.
7. Median segment with a blunt tubercle on each side of the truncation, below the large spines of the apical angles *N. punctatissimus*, Turn.
- Median segment without tubercles below the spines of the apical angles 8.
8. Segments 3-5 with a distinct spine on each side at the apical angles; ventral segments 2-5 with an apical fringe of long hairs *N. obliteratus*, Turn.
- Segments 3-5 without spines 9.
9. Ventral segments 2-5 with an apical fringe of long hairs *N. gilberti*, Turn.
- Ventral segments without a fringe of long hairs 10.
10. Basal abdominal segment red *N. spiniger*, Turn.
- Basal abdominal segment black *N. tasmanicus*, Turn.

♀ ♀.

1. Sixth dorsal segment serrate at the sides, with three or four teeth; segments 3-5 with acute spines on each side at the apical angles 2.
- Sixth dorsal segment not serrate; segments 3-5 without spines 3.
2. Enclosed area of median segment with about five longitudinal carinae *N. nudiventris*, Turn.
- Enclosed area of median segment without distinct striae or carinae *N. brisbanensis*, Turn.
3. Median segment with a short blunt tubercle on each side of the truncation below the spines of the apical angles. . *N. punctatissimus*, Turn.
- Median segment without tubercles below the spines of the apical angles 4.

- | | |
|---|------------------------------|
| 4. First abdominal segment ferruginous | 5. |
| First abdominal segment black | <i>N. tasmanicus</i> , Turn. |
| 5. Dorsal surface of the median segment
much shorter in the middle than the
scutellum | 6. |
| Dorsal surface of the median segment
about as long in the middle as the
scutellum | <i>N. gilberti</i> , Turn. |
| 6. Pronotum ferruginous; length 8 mm. . . | <i>N. mysticus</i> , Gerst. |
| Pronotum black; length 4·5 mm. | <i>N. spiniger</i> , Turn. |

Nysson (Acanthostethus) nudiventris, sp. n.

♂. Niger; mandibulis, antennis, pedibus segmentoque abdominali primo ferrugineis; segmentis dorsalibus 1-5 fascia angusta apicali utrinque flava; alis hyalinis, leviter infuscatis; segmento dorsali septimo apice quinquedentato.

♀. Mari similis, segmentis 2-5 apice et lateribus ferrugineis; segmento sexto dorsali serrato.

Long., ♂ 5·5, ♀ 6·5 mm.

♂. Head and thorax coarsely rugose, dorsal area of the median segment coarsely longitudinally striated, abdomen closely punctured. Apical joint of the flagellum scarcely curved, longer than the penultimate. Abdominal segments 3-5 with an acute spine on each side at the apical angles; seventh dorsal segment with five apical spines, the three middle spines long and even, the outer spine on each side much shorter. Second recurrent nervure interstitial with the first transverse cubital nervure, second cubital cell pointed on the radius.

♀. Dorsal surface of the median segment much shorter than the scutellum, the basal area with about five longitudinal carinæ. Abdominal segments 3-5 with an acute spine on each side at the apical angles; sixth dorsal segment rounded, the sides serrate, with three teeth on each side. Hind tibiæ almost smooth. Second ventral segment not angular at the base. Second cubital cell with a very short petiole.

Hab. Yallingup, S.W. Australia; December.

A pair taken on *Leptospermum* blossom.

The male has no fringe of long hairs on the ventral segments.

Nysson (Acanthostethus) brisbanensis, sp. n.

♀. Nigra; mandibulis, antennis, pedibus, tegulis segmentisque abdominalibus primo sextoque ferrugineis, segmentis dorsalibus 1-5 fascia apicali continua flava; alis hyalinis; segmento dorsali sexto serrato.

Long. 6·5 mm.

♀. Head and thorax rugose, abdomen closely punctured; basal area of median segment irregularly and rather finely reticulate; sixth dorsal segment rugose. Clypeus without carinæ, very shallowly emarginate at the apex, the angles of the emargination very feebly produced. Median segment much shorter than the scutellum. Second ventral segment convex, not angular at the base; segments 3-5 with a spine on each side at the apical angles; sixth dorsal segment rounded, serrate at the sides, with at least four teeth on each side. Hind tibiæ almost smooth. Second recurrent nervure interstitial with the first transverse cubital nervure; second cubital cell petiolate.

Hab. Brisbane; January (*Hacker*). From the Queensland Museum.

This is near *nudiventris*, but the sculpture of the median segment differs; also the shape of the pygidium and the number of teeth on the sides.

Nysson (Acanthostethus) confertus, sp. n.

♂. Niger; flagello basi subtus, scapo apice, tegulis, abdomine segmento primo, segmentis 2-7 linea transversa apicali, pedibusque ferrugineis; segmentis dorsalibus 1-5 macula transversa apicali utrinque flava; alis hyalinis, venis fusco-ferrugineis.

Long. 7 mm.

♂. Clypeus widely and shallowly emarginate at the apex, the angles of the emargination produced into short spines. Apical joint of the flagellum slightly curved, hollowed beneath and scarcely longer than the penultimate. Head, thorax, and abdomen closely punctured, the punctures on the abdomen becoming gradually finer from the base; basal area of the median segment coarsely longitudinally striated, the dorsal surface of the median segment as long as the scutellum. Ventral segments 2-4 with an apical fringe of long whitish hairs, segments 3-5 with a small spine on each side at the apical angles; seventh dorsal segment with three spines at the apex, the middle one blunt and subtriangular. Second recurrent nervure interstitial with the first transverse cubital nervure, second cubital cell with a short petiole.

Hab. Cairns, Queensland (*Dodd*).

I do not think that this can be the male of *brisbanensis*, owing to the much longer median segment, the difference in the sculpture of the median segment, and the much finer puncturation.

Nysson (Acanthostethus) minimus, sp. n.

♂. Niger; mandibulis, scapo, flagello articulis tribus basalibus, pronoto, tegulis, segmentis abdominalibus subtus, segmento dorsali primo, nonnumquam nigro-maculato, segmentis 2-7 linea transversa apicali, pedibusque ferrugineis; segmentis dorsalibus 1-4 macula transversa utrinque flava; alis hyalinis, venis fuscis.

Long. 4-5 mm.

♂. Coarsely punctured, the abdomen very finely and closely punctured, with large scattered punctures on the basal segment and on the second ventral segment, dorsal surface of the median segment as long as the scutellum, the basal area irregularly obliquely striated. Clypeus widely emarginate at the apex, the angles of the emargination not produced into distinct teeth. Ventral abdominal segments 2-4 with a fringe of long hairs at the apex, segments 3-5 with a spine at the apical angle on each side, seventh dorsal segment with three apical teeth, the middle one blunt and broad. The apical joint of the flagellum is rather strongly curved and hollowed beneath, longer than the penultimate. Second recurrent nervure received by the first cubital cell very near the apex; second cubital cell small, with a short petiole.

Hab. Kuranda, N. Queensland (*Dodd*) (*G. Turner*); March.

This is near *confertus*, but differs in the sculpture of the median segment and the neurulation.

Nysson (Acanthostethus) mærens, sp. n.

♂. Niger; mandibulis basi pedibusque ferrugineis; antennis fuscis apice ferrugineis; tegulis fusco-ferrugineis; segmentis dorsalibus primo secundoque linea apicali brevi utrinque flava; alis hyalinis, leviter infuscatiss; segmento dorsali septimo apice obtuse tridentato.

Long. 6.5 mm.

♂. Head and thorax coarsely punctured-rugose, abdomen closely and rather shallowly punctured; basal area of median segment irregularly longitudinally striated, the surface of the posterior truncation finely longitudinally striated in the middle, rugose on the sides. Apical joint of the flagellum conical, nearly twice as long as the penultimate. Median segment much shorter in the middle than the scutellum. Segments 3-5 with a distinct spine on each side at the apical angles; seventh dorsal segment broad,

tridentate at the apex, the middle tooth very blunt, and almost more of an angular apex to the segment than a tooth. Hind tibiæ feebly serrate. Second recurrent nervure interstitial with the first transverse cubital nervure, second cubital cell petiolate, the petiole extremely short.

Hab. Yallingup, S.W. Australia; January.

In colour this resembles *tasmanicus*, but is distinguished by the spines on segments 3-5 and the shape of the seventh dorsal segment. There is also a fringe of long hairs on the apex of ventral segments 2-5 in the present species, but not in *tasmanicus*.

Nysson (Acanthostethus) gilberti, sp. n.

♀. Nigra; mandibulis basi, scapo subtus, flagello articulis duobus basalibus, tegulis, segmento dorsali primo dimidio basali, segmento sexto, pedibusque ferrugineis; segmento mediano angulis apicalibus segmentisque dorsalibus linea angusta apicali aureo-pilosis; alis hyalinis, venis nigris.

♂. Feminæ similis, segmentis dorsalibus primo secundoque linea apicali angusta flava.

Long., ♀ 8 mm., ♂ 7 mm.

♀. Clypeus almost truncate at the apex, with an acute spine on each side. Head and thorax coarsely punctured; basal segment of the abdomen strongly, the other segments rather finely punctured; pygidial area rugulose. Median segment as long in the middle as the scutellum, the basal area coarsely but irregularly longitudinally striated. Second ventral segment not angular at the base. Second recurrent nervure received close to the apex of the first cubital cell, not quite interstitial with the first transverse cubital nervure; second cubital cell with a short petiole. Hind tibiæ feebly serrate.

♂. Seventh dorsal segment with an apical spine on each side, the space between the spines very feebly rounded; third to fifth segments without spines at the apical angles; segments 2-5 with an apical fringe of long hairs; second recurrent nervure interstitial with the first transverse cubital nervure; second cubital cell pointed, not petiolate.

Hab. Cairns, N. Queensland (*Turner*); December to February.

I think I have associated the sexes rightly, the slight differences in the neurulation do not appear to be of specific importance.

The female is the type.

Nysson (Acanthostethus) tasmanicus, sp. n.

♀. Nigra, opaca, dense punctata; mandibulis pedibusque rufotestaceis; segmentis dorsalibus 1-5 macula transversa laterali utrinque flavidula; alis hyalinis, venis nigris.

Long. 6 mm.

♀. Clypeus broadly and shallowly emarginate at the apex. Antennæ inserted as near to the eyes as to each other, gradually thickened to the apex, the apical joint nearly twice as long as the penultimate. Eyes separated at the base of the clypeus by a distance equal to about twice the length of the scape, strongly divergent towards the vertex, the posterior ocelli half as far again from the eyes as from each other. Head closely and rather finely punctured, clothed with short silver pubescence; a strong longitudinal carina on the front between the antennæ, not reaching halfway to the anterior ocellus. Thorax rather more coarsely punctured than the head; median segment irregularly rugose-striate, the posterior angles produced into stout spines and clothed with silver pubescence. Abdomen closely punctured, but less coarsely than the thorax, second ventral segment more coarsely punctured, apical dorsal segment broadly triangular and punctured-rugose. Second cubital cell pointed, sometimes distinctly petiolate, second recurrent nervure interstitial with the first transverse cubital nervure. Hind tibiæ almost smooth, with a few very short spines.

Hab. Mount Wellington, 2300 ft.; Eaglehawk Neck, S.E. Tasmania. February.

Near *A. punctatissimus*, Turn., but differs in the form of the clypeus, the finer puncturation, and the smoother hind tibiæ.

The male is very similar to the female, it has the seventh dorsal segment broadly truncate at the apex, with a spine at each of the apical angles. There is no fringe of long hairs on the ventral segments.

Subfamily *CRABRONINÆ*.*Key to the Australian Species of Rhopalum.*

♀ ♀.

- | | |
|---|---------------------------------|
| 1. First abdominal segment shorter than the second | 2. |
| First abdominal segment as long as or longer than the second | 3. |
| 2. Head very large; eyes nearly as far from the posterior margin of the head as from each other | <i>R. macrocephalus</i> , Turn. |

- Head not unusually large; eyes more than twice as far from each other as from the posterior margin of the head. *R. frenchii*, Turn.
3. Hind tibiae not perceptibly spinose 4.
Hind tibiae more or less spinose 5.
4. Pronotum rounded at the angles; intermediate femora yellow; abdomen marked with ferruginous *R. tenuiventre*, Turn.
Pronotum transverse, angles well defined; abdomen and intermediate femora black *R. eucalypti*, Turn.
5. Abdomen more or less red 6.
Abdomen wholly black 7.
6. Spines of hind tibiae strong; petiole distinctly longer than the second segment *R. tricolor*, Sm.
Spines of hind tibiae feeble; petiole equal in length to the second segment *R. tricolor imbelle*, Turn.
7. Pronotum transverse, the angles well defined 8.
Pronotum rounded at the angles 9.
8. Wings fusco-hyaline; a very broad depression from the inner margin of the eye nearly reaching the posterior ocelli; basal area of median segment finely and closely punctured *R. leptospermi*, Turn.
Wings hyaline, iridescent; a narrow sulcus from the inner margin of the eye to the posterior ocelli; basal area of median segment rugose *R. cygnorum*, Turn.
9. With a broad depression from the inner margin of the eye nearly reaching the posterior ocelli 10.
Without a depression from the inner margin of the eye towards the posterior ocelli *R. littoralis*, Turn.
10. Median segment with a longitudinal sulcus; recurrent nervure received beyond three-quarters from the base of the cubital cell *R. aliciae*, Turn.
Median segment without a sulcus; recurrent nervure received at about three-fifths from the base of the cubital cell *R. variatarise*, Turn.

Rhopalum macrocephalus, sp. n.

♀. Nigra; mandibulis, apice excepto, scapo, flagello articulo primo, tuberculis humeralibus, tegulis, coxis anticis subtus, trochanteribus, femoribus anticis intermediisque, tibiis tarsisque anticis et intermediis, tibiisque posticis basi flavis; segmentis abdominalibus margine apicali et subtus fusco-ferrugineis; alis hyalinis, venis nigris.

Long. 6 mm.

♀. Head shining, very large, longer than broad; the

posterior ocelli nearly as far from each other as from the eyes, more than twice as far from the posterior margin of the head as from each other; eyes separated at the base of the clypeus by a distance about equal to half the length of the scape. Thorax narrower than the head; the pronotum depressed, strongly rounded at the angles; mesonotum shining; microscopically punctured, without a sulcus. Median segment smooth, with a shallow and rather indistinct median sulcus, a narrow transverse foveolate groove at the base. First abdominal segment a little shorter than the second, the apical half somewhat swollen, but not forming a conspicuous node. Hind tibiae swollen, with three or four short spines on the outer margin near the apex. Recurrent nervure received a little before two-thirds from the base of the cubital cell.

Hab. Caloundra, near Brisbane; September. On tree-trunks. (From Queensland Museum.)

There is no distinct depression between the inner margin of the eyes and the posterior ocelli. The species is easily distinguished by the great length of the head behind the eyes.

Rhopalum frenchii, Turn.

Crabro (*Rhopalum*) *frenchii*, Turn. Proc. Zool. Soc. London, p. 526 (1908). ♀.

Hab. Mt. Wellington, 2300 ft.; January to April. Eaglehawk Neck; February.

Also from Victoria; a single specimen taken at Yallingup S.W. Australia.

Taken burrowing in a bank by the roadside on Mt. Wellington, also on a *Eucalyptus* log at Eaglehawk Neck; the specimen at Yallingup was taken on a live Jarrah tree.

The male has the petiole longer and less clavate than the female. The spines on the hind tibiae are almost obsolete.

Rhopalum leptospermi, sp. n.

♀. Nigra; scapo, femoribus anticis et intermediis, femoribus posticis subtus, tibiisque anticis flavis; alis fusco-hyalinis, venis nigris.

♂. Feminæ similis; tarsis ochraceis, articulo apicali nigro. Long., ♀ 14 mm., ♂ 11 mm.

♀. Clypeus slightly produced at the apex and shallowly emarginate, the angles of the emargination forming short triangular teeth. Eyes separated at the base of the clypeus by a distance equal to about one-third of the length of the

scape; posterior ocelli more than half as far again from the eyes as from each other, a little nearer to the posterior margin of the head than to the eyes; a broad oblique depression from the inner margin of the eyes not reaching the posterior ocelli. Front strongly concave and shining, the rest of the head and thorax subopaque. Pronotum transverse, with a distinct dorsal surface, the angles well defined, not rounded, without a sulcus. Mesonotum without a sulcus; a narrow, transverse, crenulated line at the base of the median segment, the triangular area of the median segment well defined and divided by a longitudinal sulcus. First abdominal segment nearly half as long again as the second, a little swollen at the apex, the second segment about three times as wide at the apex as the first. Fifth dorsal segment thickly clothed with very delicate golden-brown pubescence; pygidial area sparsely punctured at the base, smooth at the apex. Recurrent nervure received beyond three-quarters from the base of the cubital cell, at a distance from the apex scarcely exceeding the length of the transverse cubital nervure. Hind tibiae swollen on the apical half, strongly spinose.

♂. As in the female; but the depressions on the inner margin of the eyes are much smaller, and the second abdominal segment is distinctly longer and more slender in proportion to the first.

Hab. Yallingup, S.W. Australia; October and November. Warren River, S.W. Australia (*W. D. Dodd*).

I took the male in some numbers on *Leptospermum* blossom, but the only female was taken from an Asilid fly. Mr. Dodd took two females on the Warren River, but no males.

Rhopalum cygnorum, sp. n.

♀. Nigra; scapo, femoribus, tibiis tarsisque anticis, femoribus tibiisque intermediis subtus, tarsis intermediis, tuberculisque humeralibus flavis; alis hyalinis, iridescentibus, venis nigris; flagello subtus brunneo.

Long. 5 mm.

♀. Eyes separated from each other at the base of the clypeus by a distance nearly equal to half the length of the scape; posterior ocelli far apart, farther from each other than from the eyes or from the posterior margin of the head; a narrow oblique sulcus running from the inner margin of the eyes to the posterior ocelli. Head finely and closely punctured; thorax shining, almost smooth. Pronotum transverse, with a distinct dorsal surface, the angles well

defined, not rounded; mesonotum without a sulcus. Triangular area at the base of the median segment coarsely rugose, not divided by a sulcus. First abdominal segment longer than the second, very slender at the base, swollen at the apex; the second segment about four times as wide at the apex as the first. Pygidial area sparsely punctured. Recurrent nervure received just before two-thirds from the base of the cubital cell. Hind tibiæ moderately spinose.

Hab. King's Park, Perth, W. Australia.

One female taken on *Eucalyptus* blossom.

Rhopalum variitarse, sp. n.

♀. Nigra, nitida; scapo subtus, tibiis anterioribus supra, tarsis anterioribus intermediisque, articulo apicali excepto, tarsisque posterioribus articulis tribus intermediis flavis; alis hyalinis, venis nigris.

Long. 8 mm.

Clypeus with a carina from the base to the middle, covered with white pubescence. Eyes separated at the base of the antennæ by a distance equal to about one-third of the length of the scape. A broad longitudinal groove on the inner margin of the eyes, level with the anterior ocellus. Posterior ocelli a little farther from each other than from the anterior ocellus, a little farther from the eyes than from each other, with a short longitudinal sulcus between them. Mesonotum subcarinate in the middle, basal area of the median segment smooth and shining, without a median groove. First abdominal segment as long as the second, slender at the base, the apical half strongly swollen; second segment broadened from the base; fifth segment sparsely covered with grey pubescence; pygidial area shining, sparsely punctured, elongate-triangular. Hind tibiæ much swollen towards the apex, armed on the outer side with a row of small spines. Radial cell broadly truncate at the apex, transverse cubital nervure joining the radius close to one-third from the base of the radial cell, the recurrent nervure received just beyond the middle of the cubital cell.

Hab. Mt. Wellington, 2300 ft.; January. Eaglehawk Neck; February.

Allied to the New Zealand species *R. albipes* and *R. perforator*, Sm., but differs from both in the less spinose tibiæ and in other details of structure and colour. The tarsi are coloured as in the male of *albipes*, Sm., but in that species the female differs from the male in this point.

Rhopalum eucalypti, sp. n.

♀. Nigra; scapo subtus, tarsis anticis intermediisque, tibiis anticis intermediisque supra, tibiisque posticis subtus albido-flavis; alis hyalinis, iridescentibus, venis nigris.

Long. 6.5 mm.

Clypeus without a carina, shallowly emarginate at the apex, the angles of the emargination forming very short teeth. Eyes separated at the base of the antennæ by a distance equal to about three-quarters of the length of the scape; no broad groove on the inner margin of the eye level with the anterior ocellus, but a narrow shallow sulcus runs from the eye to the posterior ocelli, which are as far from each other as from the eye. Dorsal surface of the median segment smooth and shining, with a rather obscure median sulcus and a few very short striae at the base. Petiole longer than the second segment, the apical third moderately swollen; second segment slender, fully twice as long as the apical breadth; pygidial area triangular, not very sharply defined. Hind tibiae swollen towards the apex, without spines. Radial cell broadly truncate at the apex; transverse cubital nervure joining the radius at two-fifths from the base of the radial cell; recurrent nervure received at about three-fifths from the base of the cubital cell.

Hab. Eaglehawk Neck; March.

Taken on a dead *Eucalyptus* log.

This is a more slender species than *variitarse*, and is without the groove on the inner margin of the eye and the spines on the hind tibiae. The eyes are much farther apart on the front, in this character more nearly approaching *frenchii*, from which it is easily distinguished by the long petiole.

Rhopalum aliciae, sp. n.

♀. Nigra, subnitida; scapo, tuberculis humeralibus, femoribus anticis intermediisque apice, tibiis basi, tarsisque articulo apicali excepto albido-flavis; alis hyalinis, venis nigris.

♂. Feminae similis.

Long., ♀ 12, ♂ 9 mm.

♀. Eyes separated at the base of the clypeus by a distance equal to about two-thirds of the length of the scape. Posterior ocelli nearly half as far again from the eyes as from each other, a little farther from the eyes than from the posterior margin of the head; a broad oblique depression reaching from the inner margin of the eye almost to the posterior

ocelli; a short longitudinal sulcus between the posterior ocelli. Pronotum strongly rounded at the angles, with a short median longitudinal sulcus; a shallow almost obsolete sulcus reaching from the anterior margin of the mesonotum to the middle. A narrow, transverse, crenulated furrow at the base of the postscutellum, and another at the base of the median segment; a distinct longitudinal sulcus running from the base to the apex of the median segment. First abdominal segment distinctly longer than the second, the apical half moderately swollen, half as wide at the apex as the apex of the second segment. Pygidial area coarsely punctured-rugose at the base, with a median carina, smooth and shining at the apex. Hind tibiae swollen and strongly spinose. Recurrent nervure received just beyond three-quarters from the base of the cubital cell, at a distance from the apex of the cell scarcely equal to the length of the transverse cubital nervure.

♂. The male has the head less produced behind the eyes, the posterior ocelli being only a little farther from the posterior margin of the head than from each other; the depressions between the eyes and the posterior ocelli are much smaller and the abdomen much more slender.

Hab. Yallingup, S.W. Australia; October and November.

Taken burrowing in sand, the males flying low over the sand.

Nearly related to *R. variitarse* from Tasmania, but differs in the presence of a sulcus on the median segment, in the position of the recurrent nervure, and in the sculpture of the pygidial area.

Rhopalum littorale, sp. n.

♀. Nigra; scapo subtus, tibiis anticis extus, tarsisque anticis et intermediis, articulo apicali excepto albido-flavis; alis hyalinis, iridescentibus, venis nigris.

Long. 6 mm.

♀. Eyes separated at the base of the clypeus by a distance equal to about one-quarter of the length of the scape. Posterior ocelli as far from each other as from the eyes, and about the same distance from the posterior margin of the head; a short longitudinal sulcus between the posterior ocelli. A narrow groove along the inner margin of the eyes, but no broad depression running towards the posterior ocelli. Pronotum depressed, without a distinct dorsal surface, rounded at the angles; mesonotum without a sulcus. Median segment with a transverse crenulated line at the

base, the triangular area divided by a longitudinal sulcus. First abdominal segment about equal in length to the second, the apical half rather strongly swollen; pygidial area smooth and shining at the apex. Recurrent nervure received just before two-thirds from the base of the cubital cell, at a distance from the apex almost equal to twice the length of the transverse cubital nervure. Hind tibiæ swollen and spinose.

Hab. Yallingup, S.W. Australia; November.

This is near *R. frenchii*, but the petiole is longer and the colour of the legs different. It is also a much larger species.

Rhopalum tricolor, Sm.

Crabro tricolor, Sm. Cat. Hym. B.M. iv. p. 394 (1856). ♂.

Crabro (Rhopalum) militaris, Turn. Proc. Zool. Soc. London, p. 523 (1908). ♂.

Crabro (Rhopalum) tricolor, Turn. Proc. Zool. Soc. London, p. 524 (1908). ♀ ♂.

Smith's type is lost, but from a long series of Tasmanian specimens I have no doubt there is only one species, and that *militaris*, Turn., is quite a usual form of the species, the form identified by me as *tricolor* being a dark colour-variety found in the mountain-districts of New South Wales and Victoria.

Hab. Eaglehawk Neck; February. Mt. Wellington, 2200 ft.; January.

Also from S.E. Australia. A closely allied form is common in S.W. Australia, but differs in the slightly shorter petiole, in the almost obsolete spines of the hind tibiæ, and in the slightly nearer approach to each other of the posterior ocelli. For this form I propose the name *Rhopalum tricolor imbelles*, subsp. n.

R. tricolor was taken freely on *Leptospermum*, also burrowing in sandy banks.

CRABRO (subgenus *Solenius*).

I use the name *Solenius* in a wider sense than Ashmead. The Australian species of *Crabro* do not fall well into Ashmead's genera, which were founded without the study of any large exotic collection. The species included here in *Solenius* fall into more than one group of species, but in all the female has the mandibles tridentate, a supraorbital fovea, and a carina on the mesopleuræ before the intermediate coxæ. *C. tridentatus* and *tasmanicus* have the clypeus very

differently formed from the others, the mandibles less distinctly tridentate, and a spine on the anterior femora of the male; the second joint of the flagellum is also very long. *C. ordinarius*, *manifestatus*, *bivittatus*, and *neglectus* form another group nearly related to the last; whilst *C. conglobatus* and *cinctus* have the male antennæ normal and no carina on the clypeus. In the two latter species and in *hebetescens* the tooth on the inner side of the mandibles near the base is well developed, which, so far as I can see, is not the case in the other species.

Key to the Australian Species of Crabro (Solenius).

♀ ♀.

- | | |
|--|--------------------------------|
| 1. Clypeus with a carina | 2. |
| Clypeus without a carina | 8. |
| 2. With an orange or yellow band, entire or interrupted, on the base of the second dorsal segment | 3. |
| Without an orange or yellow band on the second dorsal segment | 7. |
| 3. Clypeus produced into a strong porrect tooth at the apex, with a tooth on each side at the lateral angles | 4. |
| Clypeus not produced into a porrect tooth, lateral angles without teeth | 5. |
| 4. Transverse band of second dorsal segment orange, broad, and entire; three apical segments orange | <i>C. tridentatus</i> , Sm. |
| Transverse band of second dorsal segment yellow, narrow, and interrupted; basal half of fourth dorsal segment yellow; two apical segments black | <i>C. tasmanicus</i> , Sm. |
| 5. Fourth dorsal segment with a transverse orange or yellow band at the base | 6. |
| Fourth dorsal segment entirely black | <i>C. manifestatus</i> , Turn. |
| 6. Band of the second segment orange and broad; scutellum and postscutellum entirely black | <i>C. bivittatus</i> , Turn. |
| Band of the second segment yellow and narrow; scutellum with a yellow spot at the basal angles, postscutellum with a transverse yellow band | <i>C. ordinarius</i> , Turn. |
| 7. Second dorsal segment entirely black | <i>C. mackayensis</i> , Turn. |
| Five basal dorsal segments with lateral white spots | <i>C. hebetescens</i> , Turn. |
| 8. Clypeus with a small semicircular truncation at the slightly porrect apex; anterior angles of pronotum pointed; three apical dorsal segments orange | <i>C. cinctus</i> , Turn. |
| Clypeus without an apical truncation, not porrect; anterior angles of pronotum obtuse; three apical dorsal segments black | <i>C. conglobatus</i> , Turn. |

♂ ♂.

1. Basal joints of the flagellum not normal, at least with a notch between the second and third joints beneath; clypeus with a longitudinal carina 2.
 Basal joints of the flagellum normal; clypeus without a carina..... 7.
2. Anterior femora with a spine beneath near the base 3.
 Anterior femora without a spine..... 4.
3. Transverse band of second dorsal segment orange, broad, and entire *C. tridentatus*, Sm.
 Transverse band of second dorsal segment yellow, narrow, and interrupted *C. tasmanicus*, Sm.
4. Fourth dorsal segment banded with yellow or orange 5.
 Fourth dorsal segment wholly black *C. manifestatus*, Turn.
5. Scutellum and postscutellum wholly black . 6.
 Scutellum with yellow spots at the basal angles; postscutellum with a transverse yellow band *C. ordinarius*, Turn.
6. Transverse band of second dorsal segment broad and entire *C. bivittatus*, Turn.
 Transverse band of second dorsal segment narrow and interrupted *C. neglectus*, Sm.
7. Second joint of the flagellum no longer than the third; band on the second dorsal segment broad and entire; third wholly black..... *C. cinctus*, Turn.
 Second joint of the flagellum much longer than the third; band on the second dorsal segment narrow and interrupted; third with a narrow transverse band on each side *C. globatus*, Turn.

The males of *C. mackayensis* and *C. hebetescens* are unknown, as is also the female of *C. neglectus*.

Crabro (Solenius) neglectus, Sm.

Crabro neglectus, Sm. Trans. Ent. Soc. London, p. 249 (1868). ♂.

I have not included this species in the key to the females, because it is known only in the male sex. It seems to be most nearly allied to *bivittatus*, but the orange bands at the base of the second and fourth dorsal segments are narrow and that on the second interrupted; the angles of the pronotum are also more distinctly pointed and the first abdominal segment is broader and shorter.

Crabro (Solenius) tasmanicus, Sm.

Crabro tasmanicus, Sm. Cat. Hym. B.M. iv. p. 425 (1856). ♂ (as ♀).

This is in my opinion the Tasmanian race of *C. tridentatus*, Sm., the differences being mainly in colour. The orange colour, so conspicuous in Australian Aculeates, and of which *C. tridentatus* is a good example, does not seem to be indigenous in Tasmania, being confined in that island to one or two large Psammocharidæ such as *Priocnemis bicolor*, Fabr., and to the bee *Hyleoides concinnus*, Fabr., which are probably stragglers from the mainland, where they are common species.

Crabro (Solenius) manifestatus, sp. n.

♀. Nigra; scapo, pronoto, scutello macula utrinque angulis basalibus, segmento dorsali secundo dimidio apicali flavis; flagello basi, callis humeralibus, tegulis pedibusque ferrugineis; alis hyalinis, venis nigris.

♂. Feminae similis; aurantiaco haud flavo-variegatus; scutelli maculis duplicatis.

Long., ♀ 11, ♂ 7 mm.

♀. Clypeus with a carina from the base to the apex, not produced or dentate at the apex; eyes separated at the base of the clypeus by a distance equal to about one-third of the length of the scape; front concave, not margined above; second joint of the flagellum as long as the first and third combined. Posterior ocelli farther from each other than from the eyes, and farther from the posterior margin of the head than from each other; a short sulcus on each side along the inner margin of the eyes near the summit. Head very minutely, thorax more distinctly punctured; anterior angles of the pronotum acute; scutellum with a crenulate transverse furrow at the base; enclosed area of the median segment no longer than the scutellum, divided by a longitudinal groove, obliquely striated, coarsely at the sides, less distinctly in the middle, with a transverse crenulate furrow at the base. Abdomen opaque, minutely and very closely punctured, pygidial area elongate; posterior tibiae serrate. Transverse cubital nervure received just beyond the middle of the radial cell, recurrent nervure received at a distance from the apex of the cubital cell equal to about half the length of the transverse cubital nervure.

♂. Third joint of the flagellum excised at the base beneath; sculpture of the basal area of the median segment irregularly rugose; transverse cubital nervure received just

before the middle of the radial cell, recurrent nervure received at a distance from the apex of the cubital cell equal to the length of the cubital nervure.

Hab. Kalamunda, S.W. Australia; February.

The female is the type. I am not sure that these are sexes of the same species, owing to the difference in colour and in the sculpture of the median segment. The female is nearest to *bivittatus*, Turn., but differs in the sculpture of the median segment, in the absence of a band on the fourth dorsal segment, and in the yellow instead of orange markings.

Crabro (Solenius) serenus, sp. n.

♀. Nigra; scapo, pronoto fascia utrinque, callis humeralibus, mesopleuris antice macula magna, mesonoto macula parva utrinque angulis anticis, scutello macula utrinque, postscutello linea transversa, segmento mediano maculis 4 magnis, anguste separatis, segmento dorsali primo macula curvata utrinque, secundo macula transversa utrinque, tertio macula parva obscura utrinque, femoribus anticis macula apicali, tibiisque anticis externe basi flavis; alis fusco-hyalinis, apice obscure cærulescentibus, venis nigris.

Long. 12 mm.

♀. Mandibles tridentate, the inner tooth short; clypeus with a carina from the base branching in the middle and enclosing an elongate-triangular apical area, the angles of the area produced into short teeth, a short tooth on each side near the outer angles of the clypeus. Eyes separated at the base of the antennæ by a distance slightly exceeding half the length of the scape, the second joint of the flagellum as long as the first and third combined. Front between the eyes concave; posterior ocelli about equidistant from the eyes and from each other, farther from the posterior margin of the head than from each other; a broad groove along the inner margin of the eyes near the summit. Pronotum with the anterior margin slightly raised and produced into minute spines at the anterior angles. Head and thorax minutely punctured, subopaque; basal area of median segment smooth, divided by a crenulate longitudinal furrow, the sides of the segment smooth and opaque. First abdominal segment gradually broadened from the base, longer than the second, the apex about two-thirds of the breadth of the apex of the second segment. Pygidial area very narrow. Hind tibiæ serrate.

Hab. Api, New Hebrides; May (*W. W. Froggatt*).

IV.—On the British Species of *Haliplus*, Latreille, related to *Haliplus ruficollis*, De Geer, with some Remarks upon *H. fulvicollis*, Erichson, and *H. furcatus*, Seidlitz. By FRANK BALFOUR-BROWNE, M.A. (Oxon. et Cantab.), F.R.S.E., F.Z.S., Lecturer in Entomology in the Department of Zoology, University of Cambridge.

[Plates VII. & VIII.]

THE group of species which I have referred to as being related to *Haliplus ruficollis*, De G., includes seven British forms, of which only three were known in our islands until a few years ago. The group is a very difficult one, as is evidenced by the fact that three attempts have been made upon it, without, however, altogether satisfactory results.

The first attempt was made by Gerhardt (8 and 9) *, who separated six mid-European species, relying chiefly upon the sculpture and upon the lineation and markings of the elytra. He also divided the species into two groups, according as the prosternum was grooved or flat. Three years later, Wehncke (22) drew up another analytical table in which he included eleven species, but he relied upon the same characters as Gerhardt had done.

Four years ago Edwards (5) distinguished the Britannie species of the group, using, in addition to the previous authors' characters, the form of the ædeagus and its accessory lobes. Until his paper appeared five species had been passing with British coleopterists under *H. ruficollis* and *H. fluviatilis*, and of these Edwards separated all except one. Had he taken more advantage of his discovery of the ædeagal character—which is the only absolutely reliable specific one,—he might have been saved from a number of errors into which he fell. However, he did not use it for distinguishing all his species, but relied rather upon other characters which are somewhat variable. Several statements made by him are contrary to the observations of the earlier authors, and in attempting to work out my material with the aid of his paper I found it unsatisfactory.

His description of the elytral puncturation of the female of *H. ruficollis* differs, as to the extent of that puncturation, from Gerhardt's, who first observed it, and from that of all the succeeding authors (most of whom probably copied Gerhardt), and Edwards explains this by assuming that they

* See Bibliography, p. 122.

had not seen what he was able to see. The same difference of opinion occurs with regard to the sculpture of the female of *H. fulvicollis*, Er., which Edwards describes as having the elytra finely punctured across the apex and along the distal half of the suture, while the continental authors all describe it as having the elytra impunctate.

With regard to the difficulty of using the paper, Edwards describes the ædeagophore in six out of his seven species, saying nothing about it in *H. heydeni*; but, although in five of these it is obviously a character of systematic importance, in *H. fulvicollis* he describes it as similar to that in *H. ruficollis*—a statement which, if correct, would to my mind reduce the former from specific rank. As a matter of fact, Edwards never saw *H. fulvicollis*, as I shall show later on.

Edwards figures the male armature in three species of the seven, but I found in working out my material that I had dissected out six different types without coming across one which agreed accurately with any of his figures.

These points, and several other details to which I shall refer in due course, induced me to undertake a re-investigation of the group, and, with that end in view, I have collected several thousands of small *Haliphi* in various parts of the British Islands*. Through the kindness of several friends I have also seen a large number of other British specimens, and I have seen some continental ones also

* I should perhaps explain my method of collecting and how I satisfied myself as to the specific identity of the females. I collected a number of specimens of small *Haliphi* from some particular spot, and a collection from any one place was kept separate from a collection from any other place, the specimens usually being placed at once in tubes of alcohol, each tube being registered under a number. Thus, in the course of a few hours' collecting, I might have eight to ten collections, some containing two or three specimens, others containing fifty or a hundred—the contents of each tube being a sample from some one pond, lake, ditch, or other type of habitat. The contents of each tube were later overhauled, males being separated from females and identified by the ædeagus, and then attempts were made to allocate the different females. If, as sometimes, I got a large collection containing only one species of male, the probability was that at least the majority of the females belonged to that same species and it was thus possible to associate females with one type of elytral sculpture, form of thoracic striae, or other secondary character, with a certain type of male. This was again checked by comparing other collections and finding that, as a rule, a particular type of female was associated with one type of male.

But, although I speak of "females of a particular form," as if seven types of female could be separated at a glance and only required to be allocated to the seven types of male, the matter is not really an easy one for the very reason that the characters used are variable, and thus females have been much more difficult to distinguish than the papers of the three authors mentioned would indicate.

through the kindness of several entomologists, Captain Sainte Claire Deville of Paris, Dr. Everts of 's Gravenhage, and the late Herr Ganglbauer of Vienna. Herr Reitter of Paskau and Herr Schulz of Hamburg have also supplied me with specimens which have been useful.

It is after working through all this material that I have come to the conclusion that the only entirely reliable character for separating the seven species of the group is the form of the ædeagus, and that, although the other characters referred to are useful in allocating an individual to a particular species, they not infrequently contradict one another, so that in some cases it is extremely difficult to come to a decision at all in the case of the females.

Apparently these characters and others which I find even less useful are not universally variable, as Roberts (16), for instance, who has written a long paper on North American Haliplids, says that "the structural characters most useful in separating the species are the form and markings, such as depressions, margins, &c., of the prosternal process, metasternum and coxal plates, as well as the shape and structure of the parts of the upper surface of the body," and he further lays stress upon the value of maculation, but this specially applies to the genus *Peltodytes*, as he mentions that in *Haliphus* variation in colour-markings is not at all uncommon.

I will now discuss the value of the chief characters which have been used in separating the species.

GENERAL FORM.

A character upon which Edwards lays some stress is the general form of the insect, and this involves the shape of the thorax and the outline of the elytra. Now there is no doubt that the general form is decidedly useful as a guide in separating the species, although the differences are more apparent than real, but it is usually possible to allocate individuals to one of two categories as laid down by that author.

H. ruficollis, *heydeni*, and most *nomax* have the thorax apparently more than twice as broad as long and with the sides strongly convergent in front and the elytra are usually evidently widest before the middle. *H. apicalis*, *fluriatilis*, *nomax* var. *browneanus*, *wehnckei*, and *immaculatus* usually have a thorax which appears longer in proportion to its width, with the sides less strongly convergent in front, while the elytra are usually widest in the middle, except in the case of var. *browneanus* which is a member of the other group as to this last character.

Camera-lucida drawings show that the thorax of *H. ruficollis*, *heydeni*, and *nomax* is slightly wider in proportion and that the sides are slightly more convergent, but it is surprising how slight in reality these differences are.

With regard to the form of the elytra I have spent much time in trying to make camera-lucida drawings of the different species, but I found that the drawing seldom resembled the model, and that even minute changes in the position of the insect—slight raising of the anterior or posterior end—gave an entirely different result in the drawing. There is, however, in spite of the impossibility of figuring it, some difference, perhaps in curvature of surface and light reflection, which is quite indefinable, but which is useful.

But variations in form occur within a species, and the members of one group approach and sometimes even overlap those of the other. *H. nomax*, for instance, seems to be specially variable and some individuals are evidently widest across the middle of the elytra. *H. ruficollis* and *wehnckeï* also vary somewhat, so that caution is necessary in making use of this character.

THE ELYTRAL STRIÆ.

Edwards divides the species into two groups according as "the dark lines 1-4 [are] unequal in width, distinctly widened on the disc, 5-7 interrupted at the base, in the middle, and at the apex, and often confluent," or "1-4 of uniform width throughout, 5-7 less decidedly or not at all interrupted," and in this character I find some variation, especially as regards *H. wehnckeï* and also in *H. nomax* which was unknown to Edwards.

It is often very difficult to determine the females of *H. wehnckeï* as distinct from those of *H. ruficollis*, but males of the former not infrequently show elytral lineation of the same type as that described for the latter, and females, which, on the majority of characters, belong to the former, even more frequently on this character should belong to the latter. In *H. nomax* the majority would belong to the "*ruficollis*" section, but some have a clear lineation which would place them with the "*wehnckeï*" section, and in this species at least the extent to which the black overflows the lines and runs into patches varies greatly in different localities.

In all the species there seems to be a tendency for the black lines to break up, but it is, I think, rarest in *H. apicalis* and *H. immaculatus*. This character is not therefore of great value in separating the species, although as an indicator it is frequently useful.

THE PUNCTURATION OF THE ELYTRA IN THE FEMALE.

Apparently Gerhardt was the first to discover differences in the extent to which the elytra of the females of the different species are covered with a very fine puncturation, and he mentions that in *H. ruficollis* the apical half of the elytra is thus punctured*. Now Edwards found that in *H. ruficollis* the elytra are entirely punctate and consequently assumed that Gerhardt, Wehncke, and others were wrong. Bedel (2) had already said that he could find "autres les trois types séparés par M. Gerhardt, toutes les nuances de transition dans la forme générale, la coloration foncière, le dessin des élytres et la force de la ponctuation," but Edwards assumed that he also was wrong.

After examining large numbers of specimens I have satisfied myself that, although in the majority of females of British and Irish *ruficollis* the elytra are completely punctate as described by Edwards, specimens occur in which, at the base, they are impunctate, even under high magnification ($\times 172$), and I have seen a few specimens in which the puncturation is even more reduced and confined to the extreme apex. Of the French specimens sent me by Captain Ste. Claire Deville, almost all were impunctate on the basal half of the elytra. The Dutch specimens sent me by Dr. Everts were more like our own, but semipunctate ones were not scarce, while none of the specimens sent me from Austria by the late Herr Ganglbauer or by Herr Reitter were completely punctate and a few were identical in puncturation with those referred to by Edwards as *H. fulvicollis*.

Both Ganglbauer and Reitter sent me as *H. ruficollis* female specimens which were quite impunctate, and in such cases, but for their larger size, I am unable to say why they should not be described as *H. heydeni*, as I can find no reliable distinctive character between the females of these two species! In one or two of these impunctate "*ruficollis*"

* Edwards finds fault with Newbery (14) for describing the elytra as "alutaceous," and says "the latter term, which I understand to express the condition found on the interspaces of the thorax of certain species of *Laccobius*, i. e. covered with minute cracks like mud or mosaic" No species of *Laccobius* with which I am acquainted has the thorax covered with "minute cracks." In *L. alutaceus*, for instance, the thorax is covered with extremely fine and close puncturation quite similar to that found on the elytra of the females of most of the *Haliphi*. The word "alutaceous" may apparently mean either "the colour of buff leather" or "leathery, coriaceous," so that Thomson presumably misapplied it in naming *L. alutaceus*, using it in the same sense as it was afterwards used by Bedel and Newbery.

there is, at the extreme apex of the elytra, a mere trace of puncturation only to be found under very high magnification and by careful manipulation of the light, but I find a similar trace in a small specimen sent me by Edwards as *H. heydeni*, and which I certainly regard as such.

Although therefore it is not correct to describe *H. ruficollis* as dimorphic, as suggested by Bedel—since all intermediate stages seem to exist between the extremes,—we may perhaps describe the completely punctate female as the “insular” form and the one in which the fine puncturation is reduced as the “continental” form, and it is interesting to note that, so far, the only specimens of the continental form which I have seen from the British Islands are from the south-east of England (Cambridge, Surrey, and Kent East).

From what has been said, it is quite clear that very little reliance is to be placed upon the elytral puncturation for determining the females of *H. ruficollis*, and, unfortunately, it is not only this species which is variable in this character. Edwards describes the females of *H. wehnckeï* as having the apical half of the elytra finely punctured and the basal half impunctate—and in many cases this is no doubt correct, but it is not always so. A few specimens taken by me in brackish pools by the River Bann, near Coleraine, Co. Derry, are, all except one, very faintly punctured to the base of the elytra. I determined these specimens, first, on the ground that only male *wehnckeï* occurred in these pools, and, secondly, on the general form, which is typical of the “*wehnckeï*” group as opposed to the “*ruficollis*” group. Again in sixteen out of eighteen female *wehnckeï* taken in one spot in the Lagan Canal, near Belfast, the elytra are punctured to the base, although the puncturation is in some cases extremely fine. Nineteen male *wehnckeï* occurred in this collection, and no male *ruficollis*, and, excepting in the character of elytral puncturation, the females do not in the least suggest *ruficollis*.

In collections made in the River Spey and in some drains in the Aviemore district (Inverness East), very faint puncturation can be seen at the base of the elytra of most of the *wehnckeï* females and a few are strongly punctured throughout.

I could give a number of other examples to show that the puncturation of the elytra of females of *H. wehnckeï* tends to vary in our islands, in some cases covering only the apical half, in others covering the whole of the elytra, and there are all grades between the extremes. My knowledge of con-

tinental specimens is limited to one or two specimens, and the species appears to be somewhat scarce. I have a note concerning one specimen from the collection of Captain Ste. Claire Deville, "♀ *H. wehnckeii*. Determined on general form only. On the first look at this specimen it appeared to be impunctate, but, by the aid of high magnification ($\times 172$), I make out extremely fine puncturation at the apex of the elytra, this extending halfway up but only along the external borders."

So far as I know, the females of *H. nomax* are always completely punctate, even in the "*browneanus*" variety, which is, according to its at present known distribution, entirely confined to south-eastern England and is therefore possibly the "continental" form of the species.

I am now satisfied that the females of *H. immaculatus*, although normally having impunctate elytra, sometimes have slight puncturation. I have several specimens which on the majority of characters agree with typical *immaculatus* females, but are more or less punctate, this puncturation in most cases, but not in all, being confined to the extreme apex of the elytra.

All females of *H. apicalis*, so far as I know, have the elytra completely punctate and all females of *H. fulvicollis*, which is not a British species, are quite impunctate, so that in these two species this female character may be as invariable as in *H. nomax*.

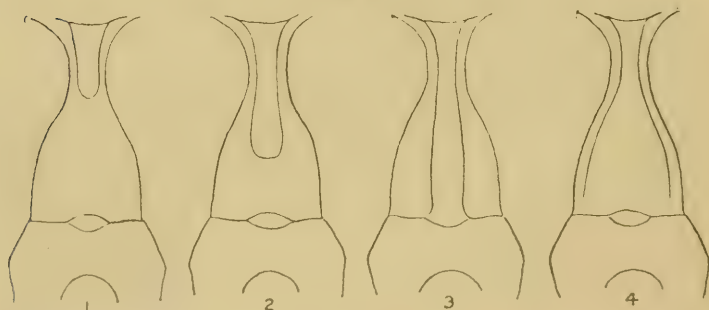
With regard to *H. fluvialis*, I gather that Edwards regards the female as always having the elytra completely punctate, though he only says "the females of this species exhibit the elytral puncturation very clearly, the surface in some examples being appreciably dull" (5, p. 8). Both Gerhardt and Wehncke refer to the female of this species as having the posterior half of the elytra finely punctured, and it is surprising that Edwards should have passed over this statement, especially after having emphasized the fact that the puncturation in those specimens he examined was such as to make the individuals dull in appearance. After examining a large number of British and Irish specimens, I have only found two in which the puncturation on the disc of the elytra was at all weak: it was there, right to the base, but it was faintly marked. One of the specimens came from the river Nidd (Kirkcudbrightshire) and the other from the River Cam (Cambridgeshire). I have seen only a few continental specimens—a series sent me by Captain Ste. Claire Deville from France, of which eight were females, and of these six at least (I neglected to note the other two) have the elytra impunctate

on the disc, even when examined under high magnification ($\times 172$). A few specimens from Silesia sent me by Herr Ganglbauer were similarly sculptured. It seems, therefore, that there are "insular" and "continental" types of female in this species also.

THE PROSTERNUM.

The sculpture of the prosternum was relied upon by Gerhardt, who separated *H. ruficollis*, *heydeni*, *borealis*, and *immaculatus*, as having a grooved or channelled prosternum, from *H. fluviatilis* and *fulvicollis*, as having a flat one. He did not attempt to distinguish between the four species with grooved prosternum on any peculiarities of the grooving, and Wehneke similarly carries the matter no farther. Reitter (15, p. 203, footnote) points out that the separation of species on the ground of grooved or flat prosternum often fails, and mentions that in *H. holsaticus*, Scriba, the male has a flat and the female a grooved prosternum. He mentions that Seidlitz and Ganglbauer have both avoided using the form of the prosternum as a specific character, but he himself describes its nature in several species.

Fig. 1.



The prosternum undoubtedly varies considerably in its shape in all the species, and is also somewhat variable in sculpture; but it is, nevertheless, sometimes useful as additional evidence in determining a species, if it is used with caution. The grooving or channelling varies from a slight depression in the anterior narrow part to a long, shallow, narrow channel to the posterior end, and there is also a further modification produced by the widening out of this channel. We might describe four degrees of grooving. The first is the minimum type; in the second the groove

extends from half to two-thirds of the way back along the middle line, while in the third it extends right to the posterior end. The fourth is the extreme development of the groove where it widens out, leaving nothing but a narrow ridge on either side, and practically the whole width of the prosternum is depressed. After an examination of a large number of specimens, I have drawn up the following descriptions of the prosternum:—

H. apicalis.—The prosternum is sparsely covered with large punctures, but closely covered with fine and very distinct ones. The grooving is of the fourth type; the two raised margins posteriorly are very slight and the groove is very “flat-bottomed,” sometimes being so shallow that the side-ridges are almost obsolete. The fine puncturation gives the prosternum a somewhat dull appearance, which is a fairly reliable characteristic for this species.

H. fluviatilis.—The prosternum is flat, with sometimes a tendency to grooving in the anterior narrow part (*i. e.* type 1, see fig. 1 on opposite page), where the large punctures are irregular in shape and give a corrugated appearance. The “process” or posterior region has large punctures, scattered and so far apart that the whole surface appears smooth and shining.

H. nomax.—The prosternum is sometimes very faintly channelled throughout (type 3), but often the insect has to be turned round in all directions, so as to get the correct illumination to see this. Often the channelling is of type 2. In both ♂ and ♀ large scattered punctures occur, and the interspaces are filled with fine puncturation; but this seldom, if ever, causes the prosternum to appear in any way dull.

H. wehncke.—The prosternum is shining and with large scattered punctures. Usually of type 3, though many examples of type 2 occur and some specimens are of type 1. Occasionally the width of the groove is increased, so that type 4 is approached. Among the large punctures is a very feeble fine puncturation in both ♂ and ♀. If, however, the groove is deep, the fine puncturation is usually distinct in it.

H. ruficollis.—The prosternum and its puncturation are much the same as in *H. wehncke*, but type 1 is, perhaps, the most usual. Type 2, however, is not uncommon, and type 3 occurs, this apparently being more common on the continent.

H. heydeni.—So far as my experience of this species goes, I can find no difference as to the prosternum between it and *H. ruficollis*.

H. immaculatus.—The prosternum usually distinctly channelled throughout its length, and sometimes the posterior part

of the groove is so widened that it spreads over the whole or most of the width of the expanded part (type 4). In both ♂ and ♀ the surface is thickly covered with large punctures, the interspaces being filled with smaller punctures, so that the whole has a rough and slightly dull appearance. These punctures are so thickly placed that they produce irregular depressions, the tendency being for these depressions to lie across the prosternum in the wider part.

H. fulvicollis is not, so far as I know, a British species, and I have only become acquainted with it because Edwards included it in his paper, and I therefore obtained specimens from two or three sources on the continent. It is really a very distinct species, not likely to be confused with any of ours. The prosternum is quite smooth, shining, and flat, except in the extreme anterior region, where there is a short groove (type 1). There is no fine puncturation, and the large scattered punctures are not so large as in other species. This description is drawn up after examination of between twelve and twenty specimens, so that, perhaps, there are variations as in our own species. When I received these specimens I also received several labelled "*fulvicollis*, var. *furcatus*."

H. furcatus of Seidlitz is, however, a quite distinct species, as will be shown later on. The prosternum is of type 4; the lateral ridges are well marked, and the central region is slightly convex, so that a depressed line runs down each side below the lateral ridge. A few larger punctures are scattered about, and in the depressed margins there is a faint trace of fine puncturation.

In all the British species there is in the metasternum, just behind where it touches the prosternum, a shallow pit, but in both *H. fulvicollis* and *H. furcatus* there is a slightly raised median ridge separating two pits (*vide* Pl. VII, fig. 10).

THE PROTHORACIC STRIÆ AND SCULPTURE OF THE THORAX.

In all the species of the "*ruficollis*" group there is, at the base of the thorax on either side, about halfway between the side-border and the median line, a small stria, the length and form of which, associated with the sculpture of the interstitial space, has been used to assist in distinguishing the different species. Gerhardt, in his fuller diagnoses of the species, says of *H. ruficollis* "thorace . . . ad basin utrinque impresso," and of *H. heydeni* and *immaculatus* "ad basin utrinque delucide impresso," while of *H. fulvicollis* he says "ad basin utrinque lineola impresso." Wehncke says that

in both *H. ruficollis* and *heydeni* the thoracic striæ are about one-third the length of the thorax; of *H. wehnckeï* he says that there is a semicircular pit inside each stria, while he mentions that in *H. schaumii*, Schilsky, the striæ are short and deep. Reitter (15) uses the presence or absence of a transverse depression of the thorax between the striæ as a systematic character, *H. ruficollis* having no such depression, while its varieties—*multipunctatus* and *heydeni*—have it, the former variety being distinguished from the latter by having the striæ straight instead of curved. He speaks of *H. wehnckeï* as having an interstitial depression. Ganglbauer (7) also lays some stress upon these characters, describing them in each species and variety.

I have found the striæ of some use as an aid in determining some of the species, but the presence or absence of a depression between them seems quite useless. In *H. immaculatus* the striæ are short and incurved, while in *H. wehnckeï*, *nomax*, and *apicalis* they are long and practically straight. In *H. ruficollis* and *heydeni*, however, although usually short and almost straight, they are sometimes distinctly incurved.

On this character, therefore, it is often easy to confuse *H. ruficollis* and *immaculatus*, on the one hand, and *H. ruficollis* and *wehnckeï* on the other. In *H. fluvialilis* the striæ are usually very short, sometimes scarcely more than a rather large puncture, but occasionally longer ones occur.

THE CHARACTERS OF THE MALE.

1. *The Anterior Tarsi and Tarsal Claws.*

Apparently Edwards was the first author to recognize any differences in the claws of the anterior tarsi of certain species of the group; but he only mentioned them in the case of two species, *H. ruficollis* and *heydeni*. According to the character of the claws our species can be separated into two groups—*H. heydeni*, *apicalis*, and *nomax*, having the pair equal or subequal, and *H. ruficollis*, *wehnckeï*, and *immaculatus*, having them distinctly unequal. *H. fluvialilis* should probably belong to the first group, but the difference between the two is more noticeable than in *nomax*, for instance, though much less than in *ruficollis*.

The form of the claw-bearing segment is useful for distinguishing *H. immaculatus*, in which it is normally short and rather thick, from *wehnckeï* and *ruficollis*, in which it is normally long and therefore thinner in appearance.

If the claws are removed and examined under high magni-

fication ($\times 600$), it will be seen that the two differ from one another in one respect. The anterior or inner claw is smooth on its concave side, while the other bears two or more teeth in two series side by side. At first I thought that the number of teeth in these series was going to give another definite specific character, but either they break off very readily or else the number varies within the species. I imagine, however, that *H. nomax* (including its var. *browneanus*, which even in this character agrees with it) has usually longer and more distinct teeth in each series than the others, there being either three or four on each side.

2. The Median Tarsi.

The form of the basal segment of the median tarsus varies somewhat in the different species, but it is of use for separating off *H. immaculatus* and *nomax* from the others, since in these two species the posterior edge is markedly concave or excised instead of being practically straight. The excision is much more marked in *nomax* than in *immaculatus*, but any confusion there might be between these two species on this character is avoided by reference to the anterior tarsal claws.

3. The *Ædeagus* and its External or Accessory Lobes.

Edwards is the only author who has used the form of the *ædeagus* as a specific character, but he failed to make full use of his discovery. The *ædeagus* with its accessory lobes readily separates all our British species, and it also makes it quite clear that *H. furcatus* of Seidlitz is a good species, and not a mere variety of *H. fulvicollis* of Erichson.

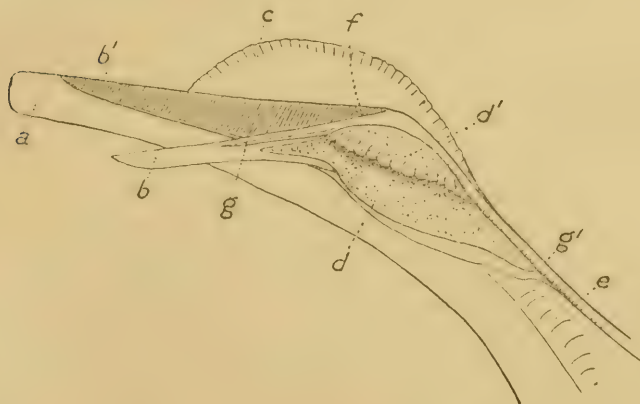
The *ædeagophore* in the Haliplids is a very peculiar structure, and, although in the different species the form differs considerably, all the forms are built upon one type, as is, of course, to be expected within a genus. Sharp (19) gives a drawing and short description of the *ædeagophore* of *H. fulvus*, F., but this happens to be one of the simpler types, and I will therefore give a general description of the structure with the aid of a diagram.

The *ædeagophore* consists of the *ædeagus*—or penis, as it used to be called—and two side-lobes, and the whole apparatus is bilaterally asymmetrical and flattened from side to side. The two side-lobes, external or accessory lobes, differ from one another, one being, as Edwards describes it, “merely a concave scale, usually oblong or subtriangular, with a rounded apex.” The shape of this “scale” varies somewhat

in the different species, but there is occasionally a small tuft of a few stiff hairs at or near the apex. This lobe is plentifully supplied with muscles, which run into it at right angles to its base.

The other lobe varies greatly in shape, being quadrilateral in some species and triangular in others, but even in the quadrilateral-shaped ones the base is always broader than the opposite side and the shape is rather that of a triangle of which one side has a slight bend in it. One of the basal angles of this lobe is greater than a right-angle, while the other is acute, and at this latter the lobe is attached to the base of the *ædeagus*. The side of the lobe running up from the angle of attachment is usually somewhat excised, and is always, so far as I know, fringed for at least part of its length with stiff hairs. At the extremity of the lobe there is usually a tuft of stiff hairs, which Edwards described as a "long curved spine" (5, p. 2).

Fig. 2.



Diagrammatic sketch of *ædeagus*, with the "tongue" (*b*) moved out of position, to show the depression (*b'*) in which it lies, and also to show the opening of the ductus ejaculatorius (*f*). *a*=main lobe; *c*=the "hood"; *d*=the saccular region, with its "wing" (*d'*); *e*=the thin wall of the ductus; *g*=the groove in the "tongue," with the continuing groove on the main lobe (*g'*).

The *ædeagus* itself (see fig. 2) is a peculiar structure, its chief peculiarity lying in the fact that it is asymmetrical. It is a strongly curved chitinous organ into which passes the ductus ejaculatorius, but this tube opens about halfway back along the organ upon what is really its left side, the opening being

protected by an elongated, more or less pointed, chitinous "tongue" (*b*), which lies forward along the side of the main lobe and in a groove (*b'*) specially shaped for it. On the outer face of this "tongue" is a groove (*g*), which commences sometimes near the apex and sometimes about halfway back, according to the species, and extends backward beyond the base of the tongue and down the dorsal aspect of the ædeagus to its base (*g'*).

On the side of this tongue or immediately posterior to it is a curious mass of material (*d*), which in several species partly bulges outwards to form a small "wing" (*d'*). This pale-coloured material is apparently an expansible sac and is easily distinguished from the dark surrounding chitin. I imagine that it is in the wall of the ductus, and capable of being bulged outwards, perhaps in the passage of the spermatophore (4). The groove already referred to, on the outside of the tongue, passes immediately dorsal to this saccular region.

On the right side of the ædeagus there is in some species a thin membrane which I have called the "hood" (*c*). It arises some way behind the apex of the main lobe, and varies considerably in extent. Sometimes it reaches nearly to the base of the ædeagus, and stands up merely as a flat membranous structure (e. g., *H. ruficollis*, *heydeni*), and in one case (*H. immaculatus*) it folds right over the convexity of the ædeagus, so as to shut in a considerable portion of the right side of it. In some cases this hood is reduced to a minute lobe (e. g., *H. nomax*), and in others it is entirely absent.

I have mentioned that Sharp's figure of the ædeagus of *H. fulvus* represents one of the simpler types, and we can trace various stages in complexity in the different species. The simplest types have no "hood" and no "saccular region," e. g., *H. apicalis* and *fluvialis*. *H. nomax* has the merest trace of a hood, but possesses an elaborate saccular membrane. *H. wehncke*i has a larger and quite distinct hood and a well-marked saccular membrane. *H. ruficollis* and *heydeni* have both structures better developed, and *H. immaculatus* has a well-marked saccular region and the highest development of hood.

The male armature of *Haliplus* is built upon exactly the same general lines as that of *Dytiscus*, which has been described by various authors. Berlesé (3, p. 320) calls the main lobe the "hypophallus" and the tongue the "epiphallus." Blunck (4) speaks of them as the "penis" and covering-piece ("Deckapparat"), while Sharp (19) calls them "median lobe" and "membranous tongue." In *Dytiscus*, however, the whole armature is fairly symmetrical,

and the two accessory lobes (parameres or periphallie lobes) are alike, and the ædeagus itself is deeply channelled along its convex side, the "tongue" lying over this median channel. On the upperside of the tongue and along its median line is a distinct ridge, and I imagine that, in the asymmetrical flattening of the whole apparatus in the *Haliplids*, this ridge has become bent over so as to form the lip of the groove which runs along the outer face of this tongue.

In a state of rest the ædeagus with its accessory lobes lies on its side within the last abdominal segments, the concavity of the ædeagus being towards the left side of the insect, and the scale-like lobe lies above the ædeagus and the other below. It is difficult, except by comparison of the armature with other and regular types, such as *Hydrophilus*, to realize the orientation of the parts, but by such comparison it becomes evident that the curvature of the ædeagus has necessitated its being varied from its normal position, and that, in a state of rest, it lies upon its left side, the concave edge being the true dorsal side of the organ. When protruded the whole armature turns on its axis through an angle of 90° , so that the dorsal side becomes ventral and the left accessory lobe lies on the right side; then, by the bending of the region immediately behind the accessory lobes, the whole armature is bent downwards and forwards, so that the dorsal side once more becomes uppermost as it enters the vagina of the female.

THE BRITANNIC SPECIES.

1. *H. apicalis*, Thomson, is, I believe, identical with *H. striatus*, Sharp.

This species was first described in 1867, and no mention is made of it by Sharp in his description of *striatus* in 1869. Presumably he did not know Thomson's species. In his description Sharp remarks the resemblance between his species and *H. fluvialis*, and points out that if this latter species is merely a variety of *H. ruficollis*, then *H. striatus* is only another variety. No one had at that time worked at the *Haliplidæ*, so that very little was known about them, and it seems that many subsequent authors have had no knowledge of Sharp's species beyond his description of it, and have accepted the suggestion that it may be a varietal form. Ganglbauer (7), for instance, disregarding the work of Gerhardt and Wehncke, includes not only *striatus*, but also *wehncke* and *immaculatus*, as varieties of *ruficollis*. Reitter (15, p. 204) describes *striatus* as an aberration of

H. fluviatilis, gives its distribution as including "Prussia, Pomerania, Silesia, and Moravia," and says it is "not rare." Reitter apparently knew Thomson's species, because he sent me Norwegian specimens of it, and he must therefore have meant something else by *striatus*. Zaitzev (23) describes *striatus* as a variety of *fluviatilis*, and says that it occurs in the St. Petersburg district; but he makes no mention of *apicalis*.

Only two authors, so far as I am aware, have in any way connected the two names. Seidlitz (17) mentions "*striatus*, Wehncke," and in a footnote says that *striatus*, Sharp, is not determinable, as the description dates from a time when only two or three species of the *rufigollis* group were separated; and this although the types are in existence and the author is still living! In the range of this species Seidlitz includes Sweden, but he adds a note in which he says that the Swedish specimens were sent as *H. apicalis*, Thomson, but are without the characteristics which Thomson attributes to that species.

I can find nothing in Thomson's description which does not apply to Sharp's species and nothing in Sharp's description which will not suit Thomson's species; but, apart altogether from these descriptions, the specimens sent me as *apicalis* both by Ganglbauer and by Reitter, and which came from Borkum Island, Norway (Christiania and Tromsö), and Sweden, agree in every respect with my examples of *H. striatus*, which agree with specimens of this latter both in Dr. Sharp's collection and in that of the late Wm. Lennon, of Dumfries, who also took the species in the original locality.

The other author who associates the two names is Lucas von Heyden (10), who actually gives *striatus* as a synonym of *apicalis*!

Of course, I have not seen Thomson's type-specimens, and am only relying upon Scandinavian specimens received from two independent sources.

In the Britannic area *H. apicalis* is confined to coastal waters and is practically a brackish-water species. Thomson says that he took it in brackish water. If Heyden's identification is correct, a single specimen has occurred inland at Frankfurt, and it is quite possible that the species may occur normally inland on the continent, as other species, which with us are confined to brackish water, are found under better conditions on the mainland of Europe (e. g., *Laccophilus variegatus*, Germ., *Calambus parallelogrammus*, Ahr., *Philhydrus maritimus*, Thoms., &c.).

The species is apparently very local in our islands, though

I expect that it is more widely distributed than the records indicate. The only Irish locality is in Co. Down, where it occurs fairly commonly in pools on the salt-marsh at Killough. The only Scottish records are for Dumfries and Kirkcudbright, while the English records are for Durham, Yorks N.E., Norfolk E., Suffolk E., Kent W., and Hants S., and Warwick, where it is described as being "local and rare at Knowle," probably erroneously (6).

With regard to the characters for determining the species, I have drawn up a short summary, which may be useful, although, as I have already said, the species are very difficult to distinguish except by examining the male armature.

General Summary of Characters.—

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| | 1. General form long and rather parallel-sided. |
| | 2. Thorax not more than twice as broad as long; the sides practically straight. |
| | 3. Thoracic striæ long and straight. |
| A. | 4. Elytra with the black lines usually not spreading into patches; lines not usually broken. |
| | 5. Prosternum flat, with a tendency to be slightly concave; somewhat dull in appearance, owing to closely-set fine puncturation amid scattered large punctures. |
| ♂. | 1. Ant. tarsal claws almost equal in length. |
| | 2. Basal segment of median tarsus not excised on posterior side. |
| ♀. | 1. Elytra covered with fine puncturation. |

With regard to aedeagal characters, the figures show all that is necessary. Note the narrow triangular form of the left accessory lobe, with its dorsal edge slightly concave and fringed with a row of fine stiff hairs, which row extends to the blunt apex and ends in a small tuft. Edwards wrongly describes and draws this lobe as without the hairs. The side of the tongue shows a thin chitinous patch slightly creased longitudinally. Possibly this is of similar use to the more elaborate saccular region of the more complex types.

2. *H. fluvialis*, Aubé.

This species is almost confined to running water, and is, in fact, the most typically "river species" of the "*ruficollis*" group. It is superficially, perhaps, the most easily distinguished species, which, however, is not saying very much. It is fairly widely distributed throughout the Britannic area, and also on the continent, and, as we have seen, the female shows variations with regard to the fine puncturation of the elytra. The species is recorded from most parts of Ireland and England, but there is, so far, no Welsh record, and it seems to be absent from Scotland north of Stirling. I failed

to find it in Fife, Forfar, Inverness E., Perth Mid, or any of the western islands I have worked, and it did not occur in the Isle of Man. Continental records range from Norway and Siberia to the Mediterranean district; but, in view of the general confusion which has existed as to the *ruficollis* group, they require confirmation.

General Summary of Characters.—

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| | A. { | 1. General form rather long, but not parallel-sided. Elytra widest about the middle. |
| | | 2. Thorax not more than twice as broad as long, the sides almost straight. |
| | | 3. Thoracic striæ usually very short; little more than large oblong punctures. |
| | | 4. Elytra with the black lines spreading in such a way that, from a short distance, dark bands alternating with light ones appear to run obliquely from the shoulders to the median suture, one such dark band being at extreme base, another reaching the median suture about halfway back, and a third about halfway between that and the apex. |
| | | 5. Prosternum shining, with slight tendency to bulge in median line; large punctures scattered, and at most only a trace of fine puncturation. |
| ♂. | { | 1. Ant. tarsal claws subequal, the difference between the two being distinct but not great. |
| | | 2. Basal segment of median tarsus not excised on posterior side. |
| ♀. | { | 1. Elytra usually covered with fine puncturation in Britannic specimens, but rarely smooth on the disc. Continental specimens appear to be usually impunctate in the anterior part of the elytra. |
| | | |

As to ædeagal characters, note the similarities between the ædeagus in this species and in *H. apicalis*—and the differences! Compare also the left accessory lobe in the two species.

3. *H. nomax*, mihi, Ent. Month. Mag. ser. 2, xxii. p. 153 (1911).

I discovered this species when examining my material after the publication of Edwards's paper, and its existence naturally contributed largely to my difficulties in identifying the different species with that paper. Shortly after my publication of a short note (1), Sharp (20) separated off another form, which he named *browneanus*, and which he considered, and still considers, a distinct species. He has endeavoured to convince me of the fact, but, after long considering the matter, and not without some misgivings, because of his vastly greater experience, I have preferred to regard it as a variety of my species. Whereas I regard *striatus* as a mere synonym of *apicalis*, I regard *browneanus*

as sufficiently distinct to be called a variety, and my chief reason for not separating it as a species is that in the form of the ædeagus and its accessory lobes the two are identical. Now all the other species of this group are to be distinguished on the ædeagal characters, and *nomax* and *browneanus* cannot therefore be regarded as of the same standing towards one another as either of them is to any of the other species. If they are to be regarded as separate species, they must form a distinct genus or subgenus apart from the others, and there is not sufficient justification for this.

H. nomax is, so far as is at present known, a northern and western form occurring in the following counties and vice-counties:—*Ireland*: Antrim, Down, and Carlow. *Scotland*: Clyde Isles (Arran and Bute), Renfrew, Lanark, Ayr, and Kirkcudbright. *England*: I have seen a ♂ of the species from Ledsham, Cheshire, taken by W. E. Sharp, but that was before "*browneanus*" had been separated, and I do not know to which form it belonged. Otherwise there is, so far, no English record for the type.

It is a lake-species, found most abundantly in May and June, but continuing to occur until August or even September, chiefly in the more stony parts. It, however, also occurs—though never abundantly—in rivers and canals where stony conditions may be absent, but where otherwise some lake conditions exist, such as large volume of well-oxygenated water and equable temperature.

The variety has so far only occurred in Bucks and East Anglia (Cambridge and Norfolk E.), where it seems to be almost confined to rivers and broad drains of slow-moving water, though I found it the dominant Haliplid in one or two large and deep ponds in an old clay-pit near Cambridge.

H. nomax varies somewhat in general form, usually being widest a little behind the shoulders; but in some cases the elytra are almost parallel for some distance back, while in others the widest point is about halfway back. The var. *browneanus* is apparently less variable, the form being widest a little behind the shoulders and more acute at the apex than in normal *nomax*. The thorax is slightly longer in proportion to its width, and the sides are less strongly convergent anteriorly than in the type. The insect is rather smaller than most *nomax*, and is rather more brightly coloured, owing to the dark elytral lines being narrower and the ground-colour pale yellow instead of testaceous. The usual elytral marking both in *nomax* and the variety reminds one of *fluvialis* more than of any other species.

In both the type and the variety the basal segment of the

median tarsus of the ♂ is strongly excised in the posterior margin, but in *browneanus* the segment is rather narrower, though this is variable and not a reliable distinction. Dr. Sharp tells me that "in *browneanus* the tip of the first joint [of the median tarsus of the ♂] comes off at a more abrupt angle, the second and third joints are less dilated, and the fourth is shorter"; but, after drawing a number of examples with camera lucida, I am quite unable to appreciate these differences.

General Summary of Characters.—

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| A. | { | 1. General form variable, usually with elytra widest a little behind the shoulders. |
| | | 2. Thorax not more than twice as broad as long, the sides more or less straight, more convergent anteriorly in <i>nomax</i> , less in <i>browneanus</i> . |
| | | 3. Thoracic striae usually long and straight. |
| | | 4. Elytra with black lines sometimes spreading and irregular and sometimes nearly regular. The most usual marking is not unlike that of <i>H. fluviatilis</i> , the form of which species distinguishes it from this. |
| ♂. | { | 1. Ant. tarsal claws practically equal. |
| | | 2. Basal segment of median tarsus with posterior side strongly excised. |
| ♀. | { | 1. Elytra apparently always in Britannic specimens completely covered with fine puncturation. |

As to aedeagal characters, note the smallness of the "hood," which is almost absent, and the well-developed saccular region and its "wing."

4. *H. wehnckei*, Gerh.

This species was first recognized as British by Newbery (14), who, however, identified it as *H. immaculatus*, Gerh., an error which was corrected by Edwards. In our islands this species has an extensive range, from the Hebrides in the north to the extreme south of England; and, although there are at present many gaps in its recorded distribution, these will no doubt be filled up in the course of time. Like *H. fluviatilis*, *wehnckei* occurs freely in running water, but, unlike it, it is, especially in the north and west, a lake-species, and is usually, according to my experience, the most abundant species of the group in those districts.

I have taken it in the north-east and south-east of Ireland (Derry, Antrim, Down, Armagh and Wicklow, Wexford, Waterford, and Kilkenny) and in Westmeath, and have seen specimens from Mayo W. In Scotland I have taken it in the Outer Hebrides (Lewis), Inverness E., Lanark, Renfrew, Ayr, and Kirkcudbright, and have seen specimens

from Stirling and Edinburgh. It occurred in the Isle of Man, and in England it has occurred in Chester, Gloucester E., Devon N. and S., Hants S., Isle of Wight, Kent E., Herts, Cambs, Norfolk E. and W., and Suffolk W.

General Summary of Characters.—

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| A. { | 1. | General form: elytra usually widest about halfway back and showing a more or less regular curve from shoulders to apex. |
| | 2. | Thorax not more than twice as broad as long, and the sides more or less straight. |
| | 3. | Thoracic striae usually long and straight. |
| | 4. | Elytra with the black lines seldom spreading into patches of colour, seldom broken, and usually of fairly regular width. |
| ♂. { | 1. | Ant. tarsal claws unequal, both curved to apex, especially the short inner or anterior claw (cf. <i>H. ruficollis</i>). |
| | 2. | Apical segment of ant. tarsus rather long (cf. <i>H. ruficollis</i> and <i>H. immaculatus</i>). |
| | 3. | The three basal segments of ant. tarsus with pads of hairs fine and inconspicuous (cf. <i>H. ruficollis</i>). |
| | 4. | Basal segment of median tarsus not excised on post. side. |
| ♀. { | 1. | Elytra in most Britannic specimens having fine puncturation in apical half only, but the character varies, as a fair number of individuals are faintly punctured to the base. |

The ædeagus of this species is easily recognized by the great breadth of the main lobe at its apex and by the shape of the "hood." There is no "wing," and the saccular region is not so large as in *H. ruficollis*.

5. *H. ruficollis*, De Geer.

This species has been recorded for most of the counties and vice-counties, but the records refer to different members of the *ruficollis* group. Even among the records for the species published since the appearance of Edwards's paper, there is seldom anything to indicate whether the authors have seen the paper and whether they are aware of the possibilities. I have therefore, in recording its distribution, only included records in cases where I have either taken specimens myself or seen specimens, except in the case of Gloucester E., whence Edwards records it.

There are no Scottish records north of Stirling and Cantire, except for the Outer Hebrides and Inverness (East), and the species was by no means common in either of these districts. It has occurred in Cantire, Arran, Stirling, Renfrew, Lanark, Ayr, Edinburgh, Dumfries, and Kirkcudbright. In Ireland it has been taken in Derry, Antrim, Armagh, Cavan, Mayo W., Carlow, Kilkenny, Wexford, and Waterford, and in England in Yorks Mid W., Lanes S., Chester, Salop, Gloucester E., Oxford, Devon S., Hants S., Isle of Wight,

Hunts, Cambs, Norfolk E., Suffolk E. and W., Middlesex, Surrey, Sussex E., and Kent E. and W. It also occurs in the Isle of Man.

H. ruficollis is a typical pond-species and becomes rare in peaty districts, so that it may well be absent from large tracts of Scotland and Ireland.

In the section dealing with the puncturation of the elytra of the female, I mentioned that I had impunctate continental specimens which I was unable to determine as between this species and *H. heydeni*. These females are larger than British *heydeni*, and they seem rather broader and with rather more deeply punctured elytral striæ than our *ruficollis*, and we are therefore faced with the question whether there is another species, *H. multipunctatus*, Wehncke, to be recognized in this group, and, as Sharp (20) believes that he has a British female specimen of this species, it is necessary that I should thus refer to it in this paper. I can only say that among the continental specimens in my possession I can find no male which can be associated with these larger impunctate females, except that of *ruficollis*, but I do not notice that these *ruficollis* have a less prominent ædeagal hood than our British specimens. Personally, being what Darwin called a "whole-hogger" rather than a "hair-splitter," I should hesitate to regard so small a difference as anything more than a varietal distinction.

General Summary of Characters.—

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| A. | { | 1. General form: elytra widest close behind the shoulders and narrowing rather strongly so that the apex is rather acute. |
| | | 2. Thorax apparently more than twice as broad as long, the sides curved and strongly convergent. |
| | | 3. Thoracic striæ variable; perhaps most usually short and straight, but not infrequently somewhat incurved. |
| | | 4. Elytra with the black lines almost always broken and spreading out into patches of colour. |
| ♂. | { | 1. Ant. tarsal claws unequal, both comparatively straight near apex (cf. <i>H. wehnckeï</i>). |
| | | 2. Apical segment of ant. tarsus rather long (cf. <i>H. wehnckeï</i> and <i>immaculatus</i>). |
| | | 3. The three basal segments of ant. tarsi with dense pads of hairs on under side (cf. <i>H. wehnckeï</i>). |
| | | 4. Basal segment of median tarsus not excised on posterior side. |
| ♀. | { | 1. Elytra in most Britanic specimens with fine puncturation all over. On the continent this form seems to be rare, the elytra usually varying from smooth in the ant. half to smooth nearly all over. Some Britanic specimens have elytra smooth in ant. half. |

The ædeagus of this species is sufficiently described already, as the diagrammatic figure and the accompanying description are founded upon it.

6. *H. heydeni*, Wehncke.

My acquaintance with this species has, until this year, been somewhat limited, and, until I took specimens in the New Forest (Hants S.) and in Cambridge, I had never seen it in the field, although I had seen a few specimens from the collections of various friends. It is apparently a pond-species like *H. ruficollis*, but it is more localized in our islands. I have seen specimens from Lancs S. and Chester, and there is a Leicester record, but otherwise all records are for south of a line drawn from the Wash to Hereford—Gloucester E., Oxford, Berks, Middlesex, Surrey, Kent W., ? Sussex E., Hants S., I. of Wight, Dorset, Devon N. and S., Cambs, and Norfolk E.

The species, in general appearance, is easily mistaken for a small *ruficollis*, but in the ♂ the equal ant. tarsal claws and the form of the ædeagus at once separate it. Apparently the ♀ usually has the elytra without fine puncturation or with only the apex thus marked, but there are many small females which are completely punctate which may or may not be this species.

General Summary of Characters.—

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| A. | { | 1. General form: small, most likely to be mistaken for small <i>ruficollis</i> , but usually slightly wider in proportion to length. |
| | | 2. Thorax much as in <i>H. ruficollis</i> , but with sides almost straight. |
| | | 3. Thoracic striæ as in <i>H. ruficollis</i> . |
| | | 4. Elytra as in <i>H. ruficollis</i> . |
| ♂. | { | 1. Ant. tarsal claws equal and both finely built (cf. <i>H. ruficollis</i>). |
| | | 2. Basal segment of median tarsus not excised on posterior side. |
| ♀. | { | 1. Elytra perhaps normally with fine puncturation only at extreme apex at the most, but small specimens with fine puncturation all over elytra occur, which, on this character alone, must be named <i>H. ruficollis</i> . |

The ædeagus is of a very distinct form with large hood and moderate-sized saccular region. This last has a raised part, presumably corresponding to the "wing" in *nomax* and *ruficollis*, but it is more or less globular at the anterior end of the region. The "tongue" is short and small and in the figure is shown slightly out of its groove. The left accessory lobe is in a way intermediate between the usual type and that seen in the next species.

7. *H. immaculatus*, Gerhardt.

This is another species which is chiefly found in lakes and canals. It is frequently associated with *H. nomax*, and its range in our islands corresponds fairly well with that of this species, covering, however, a larger area in the south. In

Ireland I have taken it in Antrim, Down, Armagh, Westmeath, and Wexford. In Scotland I have not taken it myself, but I have seen specimens from Stirling, Lanark, and Ayr, while in England I have seen specimens from Chester, Devon N., I. of Wight, Suffolk E., Kent E. and W., and Sussex E., and have taken it in Cambs and Norfolk E., and there are also records for Hereford, Hunts, and ? Suffolk W.

General Summary of Characters.—

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|----|---|---|
| A. | { | 1. General form: elytra much as in <i>H. wehnckeï</i> , but the insect is rather long. |
| | | 2. Thorax not more than twice as long as broad, the sides more or less straight. |
| | | 3. Thoracic striae usually very short and incurved. |
| | | 4. Elytra with black lines seldom spreading into patches of colour and usually unbroken. |
| | | 5. Prosternum usually channelled throughout its length, but sometimes the groove is so wide and shallow that the edges are scarcely recognizable, and the prosternum at first sight appears flat. |
| ♂. | { | 1. Ant. tarsal claws unequal, similar to <i>H. wehnckeï</i> . |
| | | 2. Apical segment of ant. tarsus distinctly short (cf. <i>H. ruficollis</i> and <i>wehnckeï</i>). |
| | | 3. Basal segment of median tarsus slightly excised on posterior side. |
| ♀. | { | 1. Elytra usually without fine puncturation, but specimens occur in which this exists at the apex and even more extensively. |

With regard to aedeagal characters, the left accessory lobe is different from that of all the other British Haliplids; it is bluntly pointed and has a small tuft of hairs at the apex, and about halfway down the dorsal face is a strong brush of hairs, which Edwards describes as "a large triangular tooth." The aedeagus itself has a very large hood, which conceals the base of the "tongue" and also the whole of the saccular region, which is well developed. The tongue itself is rather peculiar in form, as will be seen in the figure.

H. fulvicollis, Erichson.

The first mention of this as a British species was by Edwards, who says that all the English specimens he saw were females. Apparently his knowledge of this species depends upon specimens from Eisleben, sent to him by Herr Schulz of Hamburg, and he remarks that "the genitalia of the Eisleben male are similar to those of *ruficollis*." Further, he mentions that in the English specimens the elytra are finely punctured on the apical half only, and suggests that this had been overlooked by Gerhardt and Wehncke, "who speak of the elytra as without punctulation." Now it struck me as extraordinary that these authors should have been able to see such sculpture in the females of *ruficollis*

and yet had failed to observe it in the females of *fulvicollis*, and because of this, and also because of Edwards's remarks upon the male armature, I wrote to Messrs. Schulz, Everts, Ganglbauer, and Reitter asking for ♂ and ♀ specimens of *H. fulvicollis*, Er. My knowledge of the species rests upon the specimens sent me by the three last-named, and these specimens were all alike and agreed in all points with the descriptions given by various authors. Herr Schulz sent me eight specimens which, on examination, proved to be *H. heydeni*? (1 ♂, 1 ♀), *H. ruficollis* (1 ♂, 2 ♀), *H. immaculatus* (1 ♂), and *H. cinereus* (2 ♀)!

Through the kindness of Messrs. Edwards and Champion and Dr. Sharp, I was enabled to see the British specimens mentioned by Edwards and the Italian ♀ specimen which Edwards correctly described as *H. furcatus*, Seidl., and Mr. Edwards also sent me the Schulz specimens upon which he had relied. The British specimens are *H. ruficollis* of the continental type, and agree perfectly with the Schulz specimens and with others from various sources. *H. fulvicollis* of Eichson is a very distinct species, and is not likely to be passed over if it does occur in our islands. The pattern of the dark markings on the elytra, the form of the prothorax, and the comparatively fine punctures forming the elytral striæ are sufficient to arrest attention. The ant. tarsal claws of the ♂ are practically equal in length, the thoracic striæ are straight, and the sides of the thorax are straight.

The aedeagus with its accessory lobes is also quite distinct from that of any other British species. There is no hood; the main lobe has a large tongue, upon which is a long, nearly straight groove and there is no saccular region. The left accessory lobe is triangular, with two separate patches of stiff hairs upon its dorsal edge, one of which seems to be an elaboration of the apical tuft of the British species.

Among the specimens sent me from the Continent were several labelled "var. *furcatus*, Seidlitz," and superficially on the upper side these exactly resemble *H. fulvicollis*. They differ, however, on the underside in the sculpture of the prosternum, and, if that were the sole distinction, it would justify the action of continental authors in reducing what Seidlitz named a species to a mere variety. However, the aedeagus of *furcatus* is very different from that of *fulvicollis*, as my figure shows, and the left accessory lobe is also distinct, while even the right lobe (the scale) is slightly different, and on these grounds *H. furcatus* should be restored to the rank given it by Seidlitz.

However, these are not British species, and, beyond making this point clear, I do not need to refer to them.

I mentioned earlier in this paper that many friends have lent me material which has assisted me in the work on this group. I have been specially assisted by Dr. Sharp, who has not only lent me specimens but has also given me many hints and has brought to my notice more than one paper relating to the subject. I must also specially express my thanks to Mr. Edwards, who, among other things, courteously allowed me to see the specimens used in the preparation of his own paper. His paper undoubtedly advanced our knowledge of an exceedingly difficult group, especially as he discovered the only absolutely reliable specific character. If I have carried matters any further it is through him that I found the necessary stimulus for the work.

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EXPLANATION OF THE PLATES.

PLATE VII.

- Fig. 1. Left side of ædeagus of *Haliphus apicalis*, Thomson (*striatus*, Sharp). Drawing made from an Irish specimen.
- Fig. 2. Ditto of *H. fluviatilis*, Aubé.
- Fig. 3. Ditto of *H. wehnckeï*, Gerhardt.
- Fig. 4. Ditto of *H. ruficollis*, De Geer.
- Fig. 5. Ditto of *H. nomax*, mihi.
- Fig. 5 a. Right side of ædeagus of same species to show the "hood."
- Fig. 6. Left side of ædeagus of *H. heydeni*, Wehncke.
- Fig. 7. Ditto of *H. immaculatus*, Gerhardt.
- Fig. 8. Ditto of *H. fulvicollis*, Erichson.
- Fig. 9. Ditto of *H. furcatus*, Seidlitz.

a=main lobe; *b*=the tongue, which in figs. 1, 2, and 8 is wholly or partially thin-walled, possibly somewhat expansible; *b'*=depression in main lobe in which "tongue" lies (in fig. 6 the tongue is shown slightly out of position); *c*=the "hood"; *d*=the "saccular" region, with in some cases a free lobe or "wing," *d'*; *e*=the thin wall of the ductus ejaculatorius; *g*=the groove on the "tongue" which continues on to the main lobe, *g'*.

- Fig. 10. Prosternum (*P*), part of metasternum (*M*), and coxæ with trochanters of first and second pairs of legs of *H. furcatus*, Seidl., to show the channelling of the prosternum and the twin depressions (*a a*) in the metasternum.

PLATE VIII.

- Fig. 1. Left accessory lobe (external or periphallallic lobe or paramere) of *Haliphus apicalis*, Thomson (*striatus*, Sharp). Drawing made from an Irish specimen. View of inner side, *i. e.* the side which lies against the ædeagus.
- Figs. 2, 2 a. Ditto of *H. fluviatilis*, Aubé. Inner and outer sides.
- Fig. 3. Ditto of *H. nomax*, mihi. Outer side.
- Fig. 4. Ditto of *H. wehnckeï*, Gerhardt. Outer side.
- Fig. 5. Ditto of *H. ruficollis*, De Geer. Outer side.
- Fig. 6. Ditto of *H. heydeni*, Wehncke. Outer side.
- Fig. 7. Ditto of *H. immaculatus*, Gerhardt. Outer side.

- Fig. 8. Left accessory lobe (external or periphallie lobe or paramere) of *H. fulvicollis*, Er. Inner side.
 Fig. 9. Ditto of *H. furcatus*, Seidl. Inner side.
 Fig. 10. Right accessory lobe, which varies but little in all the above species.
 Fig. 11. Basal segment of right median tarsus of *H. apicalis*, Thoms.
 Fig. 12. Ditto of *H. fluviatilis*, Aubé.
 Fig. 13. Ditto of *H. nomax*, mihi.
 Fig. 13 a. Ditto of *H. nomax*, var. *browneanus*, Sharp.
 Fig. 14. Ditto of *H. wehnckeii*, Gerh.
 Fig. 15. Ditto of *H. ruficollis*, Deb.
 Fig. 16. Ditto of *H. heydeni*, Wehncke.
 Fig. 17. Ditto of *H. immaculatus*, Gerh.

V.—A Collection of Fishes from Lagos.

By C. TATE REGAN, M.A.

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THE collection here reported on has been made and presented to the British Museum by Mr. J. Cadman, of the Western Fisheries, Ltd. The majority of the fishes were trawled off Lagos at a depth of 10 to 35 fathoms, and this was certainly the case for the seven species described below as new. Some of the coast-fishes of West Africa are identical with those of the Mediterranean, others are known from the Cape, and there is a certain proportion of species found so far away as the coast of Brazil and the Indian Ocean; to illustrate this the known distribution of the species, other than those restricted to West Africa, is given.

1. *Squatina africana*, Regan.

Ann. Natal Mus. i. pt. 3, 1908, p. 248, pl. xxxviii.

This species was originally described from Natal; it would be of interest to ascertain whether either of the Mediterranean species of *Squatina* occurs at Lagos.

2. *Rhynchobatus atlanticus*, sp. n.

Very similar in form, structure, and coloration to the Indian *R. djeddensis*, Forsk. First dorsal fin farther back, originating behind base of pelvics; distance from end of snout to origin of first dorsal more than four times the interspace between dorsals. Spines stronger and fewer, similarly distributed except for the presence of a series on each side of the rostral cartilage and the absence of a median series

between the dorsal fins. Mouth less undulated, straight except for a median prominence in the lower jaw fitting an emargination in the upper. Upper nasal valve less extended, ending at the middle of the length of the nostril.

A single specimen, an immature male, 700 mm. in total length.

3. *Platyrrhina schoenleini*, Müll. & Henle.

This species is known from the coasts of India and West Africa, but has not been recorded from South Africa.

4. *Trygon margarita*, Günth.

5. *Elops lacerta*, Cuv. & Val.

6. *Clupea dorsalis*, Cuv. & Val.

7. *Pellonula vorax*, Günth.

8. *Arius heudeloti*, Cuv. & Val.

A specimen of 300 mm. is the first example of this species to reach the British Museum. According to the original description, "Les plaques palatines sont très-écartées et très-petites"; in the present example there is a very small patch of teeth on one side of the palate, but none on the other. A related species, *A. parkii*, Günth., has been placed in the synonymy of *A. heudeloti* by Boulenger (Cat. Afr. Fish. ii. p. 387), but differs from it notably in having two comparatively large patches of teeth on the palate, separated by an interspace much less than their own width. In addition the mouth is narrower (præmaxillary band of teeth four times as long as broad in *A. parkii*, seven times in *A. heudeloti*), the skull is less coarsely granular, &c.

9. *Heterenchelys microphthalmus*, Regan.

Ann. & Mag. Nat. Hist. (8) x. 1912, p. 324; Pellegrin, Ann. Inst. Océan. Monaco, vi. fasc. 4, 1914, p. 22, pl. i. fig. 4.

10. *Muraenesox ferox*, Costa.

Two examples, 800 and 1200 mm. in total length, show that this species, originally described from the Mediterranean, is quite distinct from the American *M. savanna*, Cuv. The vomer is armed with a series of 11 to 13 teeth, which ends posteriorly nearly at the level of the anterior edge of the eye;

the teeth are long and slender, but little compressed and very feebly tricuspid at their apices. In *M. savanna* the vomerine series ends below the posterior edge of the eye, and includes 17 or 18 teeth, which are short, compressed, and distinctly tricuspid. Other noteworthy differences are that the anterior canines of the lower jaw are much stronger and the pectoral fins are longer in *M. ferox* than in *M. savanna*.

11. *Hoplunnis punctatus*, sp. n.

Depth of body, at origin of anal fin, about 50 times in its length; tail $3\frac{2}{3}$ as long as rest of fish. Snout $2\frac{1}{2}$ diameter of eye, which is nearly twice the interorbital width. Maxillary extending well behind eye. Præmaxillary with 2 pairs of canines and 2 median teeth behind them; vomer with a series of 5 spaced canines; maxillary teeth small, biserial; mandibular teeth biserial, the outer series small except for 2 pairs of canines anteriorly, the inner series small posteriorly, of about 9 stronger spaced teeth laterally. Dorsal origin in advance of gill-opening, a little farther from eye than latter from end of snout; pectoral $\frac{1}{2}$ length of snout. Olivaceous above, silvery below; upper parts with numerous small dark spots forming irregular longitudinal series; end of tail blackish.

A single specimen, 370 mm. in total length.

Hoplunnis schmidtii, described in 1859 * from an example from Puerto Cabello, appears to differ especially in the more numerous teeth (10 on the vomer, 17 enlarged teeth in the inner mandibular series). *H. diomedianus*, Goode & Bean †, is based on a single specimen from the Gulf of Mexico; it appears to resemble *H. africanus* in having only 6 vomerine teeth, but seems to have a longer tail, the origin of the dorsal fin farther back, &c. Possibly further material may show that neither *H. diomedianus* nor *H. africanus* is distinct from *H. schmidtii*.

12. *Vomer setipinnis*, Mitch.

Both coasts of America; W. Africa.

13. *Pomadasys jubelini*, Cuv. & Val.

14. *Larimus peli*, Bleek.

* Kaup, Abhandl. Naturw. Ver. Hamburg, iv. Abh. 2, p. 20, pl. ii. fig. 4.

† Mem. Mus. Comp. Zool. xxii. 1896, p. 146, fig. 163.

15. *Sciæna nigripinnis*, Günth.
16. *Otolithus macrognathus*, Bleek.
17. *Otolithus brachygnathus*, Bleek.
18. *Otolithus senegalensis*, Bleek.
19. *Uranoscopus albesca*, sp. n.

Depth of body about 4 in the length, length of head (with lower jaw) about 3. Diameter of eye $5\frac{1}{2}$ in length of head, equal to length of snout or to interorbital width. Head as broad as deep; upper surface flattish, without prominent ridges or tubercles; interorbital depression twice as long as broad; one subopercular and four præopercular spines. Oral membrane of lower jaw produced into a flap with entire edges, about as broad as long, rounded distally. Præmaxillary teeth triserial anteriorly, uniserial laterally; mandibular teeth biserial anteriorly, the inner series stronger; laterally only 2 or 3 canines. Post-temporal spine weak; humeral spine strong, half as long as pectoral fin. 55 scales in a longitudinal series. Dorsal III, 13-14; spinous dorsal low; soft dorsal emarginate, third or fourth ray longest, $\frac{1}{2}$ length of head. Anal 13. Pectoral 18-rayed, $\frac{2}{3}$ length of head, extending to origin of anal. Caudal subtruncate. Greyish-violet; spinous dorsal black; oral flap white, conspicuous.

Two specimens, 175 and 195 mm. in total length.

The white membranous flap that can be protruded from the mouth of this species is the homologue of the vermiform or filamentous process found in related forms.

20. *Uranoscopus scaber*, Linn.

A Mediterranean species, previously unrecorded south of the Canaries.

21. *Trichiurus lepturus*, Linn.

Atlantic.

22. *Mugil cephalus*, Linn.

Mediterranean to S. Africa; also both coasts of America.

23. *Mugil falcipinnis*, Cuv. & Val.

24. *Sphyræna guachancho*, Cuv. & Val.

Tropical Atlantic, on both coasts.

25. *Galeoides decadactylus*, Bloch.26. *Pentanemus quinquarius*, Linn.

Tropical Atlantic, on both coasts.

27. *Gobius schlegeli*, Bleek.28. *Brotula barbata*, Schneid.

After careful comparison of two examples collected by Mr. Cadman with one from the Bermudas, I am unable to recognize specific differences; even the number of fin-rays is exactly the same. This is the first record of this species from the Eastern Atlantic.

29. *Lepidotrigla cadmani*, sp. n.

Depth of body about $\frac{1}{4}$ in the length, length of head about 3. Diameter of eye $3\frac{1}{2}$ to $3\frac{2}{3}$ in length of head, interorbital width 4 to $4\frac{1}{2}$. Bones of head finely granulated; præ-orbital rounded or truncated anteriorly, with 4 to 8 small spines; 1 to 3 small spines above anterior part of eye; no continuous transverse groove behind the concave interorbital region. Chest scaly; 54 to 56 scales in lateral line; 21 to 24 spiny plates at base of dorsal fins. Dorsal IX, 13-14; spines not serrated, second or third longest, $\frac{1}{2}$ or a little more than $\frac{1}{2}$ length of head. Anal 13-14. Pectoral nearly as long as head; uppermost free ray as long as rest of fin, extending to third or fourth ray of anal. Pelvics extending to origin of anal. Caudal slightly emarginate. Traces of a dusky spot on spinous dorsal between fourth and seventh spines; membrane of upper $\frac{3}{4}$ of pectoral fin, and on inner side rays also, blackish.

Five specimens, 130 to 170 mm. in total length.

L. cavillone, Lacep., of the Mediterranean, is rather similar, but differs notably in the rougher head, serrated first dorsal spine, naked chest, shorter pectoral filaments, &c.

30. *Platycephalus gruvelli*, Pellegr.31. *Dactylopterus volitans*, Linn.

Tropical Atlantic.

32. *Psettodes erumei*, Schneid.

An Indian and West-African species not yet recorded from South Africa.

33. *Hemirhombus guineensis*, Bleek.34. *Solea chirophthalmus*, sp. n.

Depth of body $2\frac{2}{3}$ to $2\frac{4}{5}$ in the length, length of head about $4\frac{1}{2}$. Upper eye somewhat in advance of lower; diameter equal to or less than length of snout, 5 or 6 in length of head and about twice interocular width. Maxillary extending to below posterior $\frac{1}{4}$ of eye. No dilated nostril on blind side. 65 to 72 scales in a longitudinal series. Dorsal 69-77. Anal 56-60. Caudal rounded, contiguous to dorsal and anal. Right pectoral 9-rayed, nearly $\frac{1}{3}$ length of head; left pectoral 7- or 8-rayed, not more than $\frac{1}{4}$ length of head. Vertebrae 8+32. Greyish, with traces of darker spots on body, series of 5 or 6 near bases of dorsal and anal apparently alternating with a series on lateral line; pectoral with a blackish ocellus.

Five specimens, 170-200 mm. in total length.

35. *Cynoglossus lagoensis*, sp. n.

Depth of body 4 in the length, length of head $4\frac{1}{2}$ to $4\frac{4}{5}$. Interocular width $\frac{2}{3}$ or $\frac{3}{4}$ diameter of upper eye, which is 3 to 4 in length of snout and 10 to 12 in length of head. Two nostrils, the posterior midway between the anterior margins of the eyes. Cleft of mouth extending behind lower eye. Dorsal 120-126. Anal 95-98. Three lateral lines on left side, one on right; 80 to 85 scales in a lateral series from above gill-opening to base of caudal; 12 scales between upper and middle lateral lines at their widest distance apart. Brownish grey.

Three specimens, 380 mm. in total length.

Related to *C. canariensis*, Steind. (Denkschr. Akad. Wien, xlv. 1882, p. 13, pl. ii. fig. 2), in which the cleft of the mouth ends below the middle of the eye, the head is smaller, the scales are more numerous, &c.

36. *Cynoglossus goreensis*, Steind.37. *Echeneis naucrates*, Linn.

Temperate and tropical seas.

38. *Batrachoides beninensis*, sp. n.

Depth of body about 6 in length, length of head about 3. Diameter of eye 10 to 12 in length of head. A horizontal fold of skin from below eye to præoperculum. Two opercular and two subopercular spines. Teeth on vomer and palatines uniserial, obtusely conical; 11 to 13 on vomer; lower jaw with a series of similar teeth and anteriorly a patch of villiform teeth; præmaxillaries with a narrow band of villiform teeth. Head naked, covered with small filiform papillæ; no scales on occiput or on throat; snout and lower jaw with fringes. Body scaly, the scales comparatively large, 10 between origin of second dorsal and lateral line. Dorsal III, 25. Anal 22-23. Pectoral 19-20, extending to origin of anal; no axillary foramen or pores. Greyish; head ornamented with irregular transverse dark bands with darker edges; body with irregular dark cross-bars and spots; dorsal and anal fins with oblique stripes; pectoral with series of spots; caudal dark at the base and also posteriorly.

Three specimens, 160 to 210 mm. in total length.

Related to *B. surinamensis*, Schneid., of the Atlantic coast of America, differing especially in the completely naked head, the larger scales, and the fewer dorsal and anal rays.

VI.—*Ants* from North and Central Australia, collected by G. F. Hill.—Part I. By W. C. CRAWLEY, B.A.

I. Subfam. *PONERINÆ*.

No. 2. *Odontomachus ruficeps*, Sm., subsp. *acutidens*, Forel.

Darwin, N.T., 15. iv. 13. ♂.

No. 21. *Odontomachus septentrionalis*, sp. n.

♂.—L. 14.8 mm. (with mandibles).

Mandibles long (2 mm.), dentate all along their inner margin; apical tooth long, rounded at point, subapical very small and pointed, preapical nearly as long as apical, broad and truncated. Head 3.5 mm. long, maximum breadth 2.5 mm., minimum (at back) 1.8 mm. Frontal area distinct; clypeus long, prolonged to a point between the frontal carinæ, anterior border truncate. Head much narrower behind and deeply emarginate. Node of pedicel very high, merging

insensibly into a long spine. The anterior portion underneath bears a broad tooth slightly inclined backwards.

Head finely striated, the medial striæ longitudinal, the lateral ones diverging round the back of head. Frontal carinæ with a few longitudinal striæ. Mandibles smooth and shining, a few deep punctures along the outer curve of the apical tooth and at the base of the preapical, and smaller ones along the rest of the mandibles. Pronotum coarsely striated circularly, mesonotum with finer transverse striæ, epinotum coarsely striated transversely. The lower two-thirds of node encircled with fine striæ. Gaster smooth and shining; the lower quarter of first segment, and the second and third segments, finely reticulate-punctate. A few scattered hairs on mandibles, head, epinotum, gaster, and underside of tibiæ. Legs and antennæ pubescent.

Dark brown; head, antennæ, and legs dark red.

One ♂. Stapleton, N.T., 21. xii. 12.

Nos. 33 and 84. *Rhytidoponera* (s. str.) *hilli*, sp. n.

♂.—L. 8.0–8.5 mm.

Mandibles striate, feebly and indistinctly dentate. Second joint of funiculus longer than the first, and about twice as long as broad. Clypeus coarsely rugose, with a slight central ridge. Head slightly convex at sides, somewhat wider in front than behind, where it is emarginate; slightly humped behind the eyes. Eyes very convex, placed just behind the middle of sides. The posterior angles are accentuated, but do not form distinct bosses. Thorax convex, sutures marked by two transversal impressions, but there is no emargination. Pronotum with a small tooth at the inferior angles. Node of pedicel high and rounded, somewhat compressed before and behind, wider than long, thicker at base than apex. Claws with one tooth.

Whole of head, except mandibles, deeply punctured with circular shining punctures, finely reticulate between the punctures; the vertex has a few longitudinal striæ. Pedicel finely striated transversely and sparsely punctured. The striæ on first segment of gaster fine and arched; second segment transversely finely striated. A scattered indistinct punctuation on whole of gaster. Pilosity almost nil; a few upright hairs on tibiæ.

Dark brown; head and thorax almost black; legs and funiculi reddish brown, base of gaster pale.

Stapleton, N.T., 1. v. 13.

No. 215 c. *Rhytidoponera* (s. str.) *incisa*, sp. n.

♂.—L. 10-10.5 mm.

Mandibles striate, feebly and irregularly dentate. Frontal area very distinct, triangular. Head somewhat longer than broad, feebly convex at sides, with a small oblong impression on the vertex. Eyes very convex, placed behind the centre of sides. Posterior angles of head formed into blunt points. Thorax convex, sutures distinct. Pronotum with a small tooth at each inferior angle. Node of pedicel rounded, broader than long, notched at the top. Claws with one tooth.

Clypeus feebly rugose and finely reticulate; front and vertex longitudinally rugose, the ridges spreading fanwise to the posterior angles of the head, leaving a space between not rugose; cheeks near base of mandibles somewhat rugose. Head, thorax, and pedicel with shallow irregular punctures; whole of body and legs finely reticulate, the reticulation extending to the bottom of the punctures. Antennal scapes and tarsi longitudinally striate; a few punctures on coxæ and very indistinct ones on first segment of gaster.

Pilosity almost nil; stiff hairs along the tibiæ and a few under the coxæ and femora.

Dull black; mandibles, legs, and antennæ dark reddish brown, apical joints of funiculi and tarsi dull red.

Alice Springs, Central Australia, 1913.

No. 30. *Rhytidoponera* (? *Chalcoponera*) *dubia*, sp. n.

♂.—L. 4.6 mm.

Mandibles triangular, finely striate, with minute teeth, apical tooth long and pointed. Clypeus feebly arched at anterior border, with a median ridge reaching to the posterior border, the latter narrowly rounded between the frontal carinæ. Frontal carinæ wide apart in front, converging slightly behind the lobe, then parallel. Frontal area not very distinct. Eyes large (larger than in *metallica*), hemispherical, placed slightly behind the middle of sides of head. Head longer than broad. First joint of funiculus as long as the second, which is less than twice as long as broad; funiculus slightly thicker at apex, but not clubbed. The scapes extend slightly beyond the occipital border. Head longer than broad, very slightly convex at sides, emarginate behind. Thorax slightly convex, at each inferior angle of prothorax is a small tooth; pro-mesonotal suture distinct, breaking the sculpture, suture meso-epinotal almost entirely effaced. Node of pedicel rounded, slightly longer than broad, under-

roath bears a long perpendicular spine. Spurs of the two posterior pairs of tibiæ very small and simple. Claws with a single tooth each side. The first (or post-petiole) and second segments of gaster of about equal length, the constriction between them fairly deep.

Head, thorax, and node of pedicel coarsely punctured with shining circular punctures (not coarsely wrinkled as in *metallica*); a few coarse striæ from the frontal area to vertex. Gaster shining, first segment and anterior half of second sparsely punctured, but not so deeply as thorax.

Pilosity almost nil; a few scattered hairs on antennæ, legs, and segment of gaster, the remaining segments ringed with sharp outstanding hairs.

Reddish, with a very slight metallic tinge; mandibles, antennæ, and legs paler.

Stapleton, N.T., 23. xii. 12.

A single ♀ in a tube containing *Euponera* (*Brachyponera*) *lutea*, Mayr., var. *clara*. Under a magnification of 100 diameters the spurs on the posterior tibiæ show no signs of pectination.

No. 30. *Euponera* (*Brachyponera*) *lutea*, Mayr.,
var. *clara*, var. n.

♂.—L. 4.5 mm.

Slightly smaller and more elongate than *lutea*, the mandibles not so deeply punctured, and epinotum rather narrower in front; spurs of middle pair of legs very sparsely pectinate, as in *lutea*. Gaster more elongate.

Pale chestnut-yellow, sometimes top of head, prothorax, and epinotum slightly darker.

Stapleton, N.T., 23. xii. 12.

No. 19. *Cerapachys* (*Syscia*) *australis*, For.

Darwin, N.T., 1. iv. 13. ♂.

No. 25. *Platythyrea parva*, sp. n.

♂.—L. 3.7–4 mm.

Mandibles finely reticulate-punctate, with one or two larger punctures, armed with eleven irregular teeth, the apical and preapical longer. Clypeus fairly convex, with a subacuminate lobe in front; lateral margins barely visible, posterior clearly marked. Frontal area indistinct. Eyes medium size, placed well in advance of the middle of sides. Head longer than broad, slightly narrower in front; sides

somewhat convex; emarginate behind; a faint ridge from behind the frontal area to the occiput. The scapes of the antennæ exactly reach the occiput; joints 3-10 of funiculus as broad or broader than long. Suture pro-mesonotal deeply marked. The declivous face of epinotum with sharp angles above, bordered. Posterior coxæ with a lamellate tooth. Node of pedicel three-quarters as wide as long, slightly narrower in front, truncate behind. Constriction between first and second segments of gaster slight. The whole body finely punctured and minutely reticulate.

Pilosity nil, except the ring of hairs round the apical segments of gaster. The whole insect covered with a fine pruinose pubescence.

Black-brown; mandibles, antennæ, tibiæ, tarsi, articulations of legs, and apex of gaster reddish yellow.

Darwin, N.T., 1. iv. 13.

No. 81. *Diacamma australe*, F., var. *levis*, var. n.

♂.—L. 11 mm.

Striation on head, thorax, and pedicel much finer than in *australe*, that on the head concealed by the pubescence. First two segments of gaster not striate, but the first very feebly reticulate, the second still more feebly. More pubescent than *australe*.

Near Adelaide Plains, N.T., 1. vi. 13.

III. Subfam. MYRMICINÆ.

No. 24. *Triglyphothrix striatidens*, Eur., var. *australis*, For.

Somewhat smaller than the typical *striatidens* from India.

Darwin, N.T., 1913. ♂.

No. 23. *Monomorium rothsteini*, For.

N.T., 30. v. 13. ♂.

No. 426. *Monomorium rothsteini*, For.

Darwin, N.T., 17. iii. 14. ♀ ♂.

No. 425. *Monomorium (Mitara) donisthorpei*, sp. n.

♂.—L. 1.7 mm.

Mandibles tridentate, smooth, and shining. Clypeus without teeth, with two carinæ widely diverging in front. Head oval-rectangular. Eyes large, slightly in advance of the middle of sides. Antennæ 11-jointed; joint 2 of funiculus

slightly longer than broad, joints 3-5 as broad as long. Club 3-jointed, the terminal joint longer than the other two together. The scape does not quite reach the posterior margin of the head. Pro-mesonotum regularly arched, without suture; the emargination between the meso- and epinotum deep. Epinotum unarmed. First node of pedicel high, slightly broader at base than at top; second slightly lower and broader.

Smooth and shining; a few striæ on the lower part of sides of meso- and epinota. Body with scattered whitish upright hairs. Antennæ hairy.

Black-brown; mandibles, tarsi, and articulations of legs paler.

Darwin, N.T., 10. ii. 14.



Profile view of thorax and pedicel of
Monomorium (Mitara) donisthorpei.

No. 26. *Solenopsis geminata*, F., var. *rufa*, Jerd.

The typical *geminata*, F., is the American form. The var. *rufa*, Jerd., the Indo-Malayan form, is cosmopolitan, and distinguished by its lighter colour and the presence of a small tooth on each side between the prosternum and mesosternum. It has been recorded from Celebes.

Darwin, N.T., 17. iv. 13. ♀ 4.

IV. Subfam. *DOLICHODERINÆ*.

No. 17. *Iridomyrmex rufoniger*, Lowne, subsp. *pallidus*, For.

Darwin, N.T., 17. vii. 13. ♀.

No. 424. *Iridomyrmex nitidus*, Mayr.

Melville Island, N.T., 14. iv. 14. ♀.

V. Subfam. *CAMPONOTINÆ*.

No. 16. *Opisthopsis haddoni*, Em.

Point Charles, N.T., 14. viii. 13. ♀.

No. 29. *Camponotus (Myrmoturba) villosa*, sp. n.

♂.—L. 9–12·5 mm.

In the ♂ major the clypeus is carinate and feebly and widely emarginate; mandibles 7-dentate, finely reticulate, with scattered piligerous points; scapes just reach the occiput. Declivous surface of epinotum half as long as basal surface. Scale high, narrow. In the ♂ minor mandibles 6-dentate, clypeus carinate, anterior border straight; scale similarly shaped, but broader and lower. Whole body very finely reticulate, more feebly on gaster, and ♂ minor less than ♂ major.

Scapes and tibiae hairy; the whole body with long scattered outstanding hairs. Yellow; head, mandibles, and gaster of ♂ major chestnut, darker, with a still darker patch on the vertex, joints of legs also darker; bases of first, second, and third gastric segments yellow; ♂ minor entirely yellow, sometimes top of head and gaster slightly darker.

Batchelor, N.T., 12. xii. 12.

✓

 No. 87. *Camponotus (Myrmoturba) maculatus*, F.,
subsp. *novæ-hollandiæ*, Mayr.

Batchelor, N.T., 12. xii. 12. ♂ major and minor.

No. 215. *Camponotus (Myrmosphyma) wiederkehri*, For.,
var. *lucidior*, For.

♀ (not yet described).—L. 16 mm.

Clypeus more convex in centre, head slightly narrower, altogether darker in colour, with the yellow border to the base of the first three segments of gaster more pronounced than in the ♂ major, but otherwise similar except for the sexual differences.

Alice Springs, Central Australia. ♂ ♀ ♂.

No. 82. *Camponotus (Myrmocamelus) ephippium*, Sm.

Batchelor, 12. xii. 12. ♂.

No. 83. *Calomyrmex albertisi*, Em.

Batchelor, N.T., 23. i. 13. ♂.

VII.—*Notes on Emballonura, with Descriptions of new Species.* By OLDFIELD THOMAS.

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JUST as in their close allies the American Sac-winged Bats (*Saccopteryx*, &c.), the members of the Old World genus *Emballonura* present very definite characters in the basal region of the skull, and especially in the structure of the "basial" fossæ*. These fossæ are always large, but vary in depth; they occupy the area between the basilar suture and the mesopterygoid fossa, from which they are separated by a saddle-backed convexity level with the back end of the pterygoids. On the floor of the fossæ are a variable number of low ridges or septa, whose presence, absence, or position afford good specific characters.

Emballonura sulcata, Mill.

Of this fine species the British Museum contains an example from Ponapé, Carolines.

Its smaller ally, *E. semicaudata*, occurs in the New Hebrides, Fiji, Tonga, and Samoa groups. Also in Rotuma, some way to the north of the Fijis.

Both these species have a single broad median septum in the basial fossa, but no lateral septa.

Emballonura atrata, Pet.

In spite of its great geographical isolation, this species is in all respects a true *Emballonura*. Its occurrence in Madagascar gives to the range of the genus *Emballonura* a great resemblance to that of *Pteropus*, its eastward extension being also almost exactly the same. But it does not extend so far north or south.

Emballonura meeki clavium, subsp. n.

Similar to the typical form in size and other external characters, including the shape of the tragus and the characteristic expanded lobate lips. But in the skull there are certain differences in the mesopterygoid and basial region.

* These fossæ, which are present in most Microchiroptera, have sometimes been called "basisphenoid" and sometimes "basioccipital." As a rule, they are more largely in the basisphenoid bone, but they extend in many forms considerably into the basioccipital. Under these circumstances, they might be simply and conveniently called "basial" fossæ.

Thus the mesopterygoid fossa is markedly shorter, the distance from the palation to the saddle-back convexity at its hinder end 1.1 mm., as compared with 1.6 mm.; it does not open quite so far forward, and the openings into the nasal chamber are not so large and the ethmoid bones are consequently less exposed. In the basial fossa, the median septum, which in *meeki* is represented by a broad low elevation, slightly grooved mesially and only running half across the fossa, consists of two low but quite distinct ridges, running back, slightly divergent, quite to the back of the fossa. In all other species, the median septum, if present, is truly median and without tendency to split into two. As in *E. meeki*, the whole fossa is rather shallow, narrow, without lateral septa or antero-lateral extensions.

Dimensions of the type (the italicized measurements taken in the flesh):—

Forearm 39 mm.

Head and body 38; *tail* 12; *ear* 13; lower leg and foot (c. u.) 23; *calcar* 16.

Skull: greatest length to front of canine 12.4; condyle to front of canine 11; breadth across facial swellings 5; mastoid breadth 7.4; front of canine to back of *m*³ 4.5.

Hab. Kei Islands. Type from Ara.

Type. Adult female. B.M. no. 10.3.1.34. Original number 855. Collected July, 1909, by W. Stalker.

Like as *meeki* and *clavium* are in all other respects, the skull-differences described above are constant through three specimens of one and five of the other. But an example from the Owen Stanley Range, New Guinea, is somewhat intermediate in character as in locality, and I therefore only distinguish the new form as a subspecies.

Emballonura beccarii, Pet. & Doria.

Judging by a drawing of the tragus of the type, kindly sent me by Dr. Gestro, I am inclined to think this will prove to be a synonym of *E. raffrayana*, Dobs., a species described after the publication of Dobson's Catalogue, and not mentioned in Peters and Doria's description. The typical localities of the two are quite near each other.

Emballonura stresemanni, Thos.

Of this species the Museum contains, besides the typical series, a number of specimens collected by the late Mr. W. Stalker in Ceram, during the B.O.U. New Guinea expedition. It has the same broad oblong tragus as *E. raffrayana*, Dobs., as is also the case with the following.

Emballonura cor, sp. n.

Tragus and ears as in *stresemanni*. Basial pit heart-shaped, with three septa.

Size about as in *E. raffrayana*. Colour Mars-brown, slightly paler below. Ears narrowed terminally, as in *stresemanni*, not broad as in *raffrayana*. Tragus broad, its breadth about half its length on inner margin, its inner edge straight, its outer slightly concave.

Skull of the same general shape as in *raffrayana*, but rather narrower. Frontal region with a similar mesial groove between the moderate facial inflations. No sagittal crest in the type, which is fully adult. Opening of posterior nares level with the lateral edges of palate, not contracted anteriorly, its edge bi-concave, with distinct median point. Mesopterygoid fossa long, its saddle-backed convexity low, grooved mesially. Basial pit large, deep, sharply defined, extending antero-laterally in front of the back of the mesopterygoid fossa in two rounded lobes, separated from the main part of the pit by low secondary septa; a well-marked mesial septal ridge present.

Teeth as in *E. raffrayana*, except that the inner lobe of p^4 has a less strongly developed anterior angle.

Dimensions of the type (taken on the dry skin):—

Forearm 38 mm.

Tragus on inner edge 2·8; third finger, metacarpus 32·5, first phalanx 9·3; lower leg and hind foot (c. u.) 22; calcar 10.

Skull: length from condyle to front of canine (c.) 12 *; breadth across facial inflations 5·8; front of canine to back of m^3 5; m^1 and m^2 combined 2·3.

Hab. Choiseul, Solomon Is.

Type. Adult skin. B.M. no. 5.1.28.2. Collected by A. Meek.

This species is readily distinguished from *E. raffrayana* and *stresemanni*, the only forms with the same broad oblong tragus, by its peculiarly shaped basial pit; from the former also by its narrow ears and from the latter by the distinct lateral septal ridges in the basial pit.

Emballonura monticola, Temm.

In *E. monticola* the basial pit is large, rounded, but rather shallow, without deep or sharply defined limits. It has normally distinct median and lateral septal ridges, dividing it into four portions, but the lateral ones tend to be reduced or obsolete in the eastern race (*discolor*).

* Brain-case distorted.

From S. Tenasserim to the Kei Islands I do not see any diversity which I should consider of specific value, but three races, characterized by size, appear recognizable as subspecies :—

Firstly, the typical *monticola* (type-locality, Java), ranging from the Malay Peninsula to Borneo, the smallest of the three, with an upper skull-length (occiput to nasal notch) about 12·8–13 mm., and the maxillary tooth-row about 5·0–5·4 mm. Both Miller's *E. peninsularis* and Lyon's *E. pusilla* seem to fall within the range of variation shown by the specimens before me. *E. anambensis* from the Anambas Is. * I do not know, but an *Emballonura* from Natuna quite agrees with Javan *monticola*.

Secondly, a very large form found in Borneo only, with upper skull-length about 14·5 mm. and maxillary tooth-row 6 mm. This is the form taken as representing *monticola* by Lyon when describing *pusilla*, but it far exceeds Javan examples of that species. Detailed measurements of it are given below.

Finally, an eastern race may be distinguished, *E. m. discolor*, Peters, ranging from Luzon, presumably through Celebes, to Amboina, Ceram, and the Kei Islands. It is intermediate in size between the other two, and has the lateral septa of the basial pit rather frequently absent.

Emballonura monticola rivalis, subsp. n.

Like true *monticola* throughout, but size larger. Bases of body-hairs whitish, as usual.

Dimensions of the type (measured on the spirit-specimen) :—

Forearm 48 mm.

Head and body 44; tail 14; third finger, metacarpus 43, first phalanx 14; lower leg and hind foot (c. u.) 26·5; calcar 15.

Skull: occiput to anterior base of canine 15·3; occiput to nasal notch 14·5; condyle to front of canine 13·8; zygomatic breadth 9·5; facial breadth 6; mastoid breadth 7·7; front of canine to back of m^3 6; combined length of m^1 and m^2 2·5.

Hab. Borneo. Type from Bida, Sarawak.

Type. Adult male in spirit. B.M. no. 3.11.2.2. Collected and presented by Cecil J. Brooks, Esq. Three specimens, and others collected in Sarawak and N. Borneo by A. Everett.

* Said to be distinguished by the absence of the usual white bases to the hairs. Size about as in *E. m. discolor*.

VIII.—*The Pycnogonida collected by the 'Gauss' in the Antarctic Regions, 1901-3.—Preliminary Report.* By T. V. HODGSON.

I REGRET that I have been so long in working out the collection of the Pycnogonidia made by the German Antarctic Expedition ('Gauss') in 1901-3. I hope that the final drawings and memoranda will be completed in the course of a few weeks at the outside, but, in order to secure the priority of description in certain species, I desire to publish the following preliminary report. The collection is a fairly rich one, and while it shows certain strong relations to those of other expeditions, it is, on the other hand, quite distinctive. It contains three new genera and twenty new species from the Antarctic and two more from tropical and temperate seas, as follows:—

Colossendeis glacialis.

Colossendeis glacialis, Hodgson, Pycnogonida, 'Discovery,' 1907.

A single specimen of this species was taken in the 'Gauss' winter-quarters.

NOTOENDEIS.

This new genus is established to mark the difference between the large and well-known *Colossendeis* and closely allied species.

Body perfectly segmented, with short and distinctly separated lateral processes and with well-developed eyes.

Proboscis very large.

Palps nine-jointed.

Oviger ten-jointed, with a terminal claw.

Notoendeis germanica.

The proboscis is as long as the body, and the terminal joints of the palps are as 8—5·5—4·5.

The body is robust and smooth.

Winter-quarters, 400 m.

Pipetta australis.

The genus was established by Dr. Loman for a tropical species, and now includes an antarctic species taken near the 'Gauss' winter-quarters in 2450 m.

The specific characters of this antarctic species are:—
 Ocular tubercle long, conical, and without eyes.
 Tarsus very short, not one-fifth the length of the propodus.

Pentanympyon antarcticum.

Pentanympyon antarcticum, Hodgson, Ann. & Mag. Nat. Hist. (7)
 vol. xiv. (1904).

This species has been recorded by every antarctic expedition, and has a circumpolar distribution.

Nymphon unguiculatum.

Body slender, with rather long but widely separated lateral processes. Quite smooth. Ocular tubercle short and stout, rounded above the eyes.

The joints of the palps vary but little, 4—5—4·5—5.

The legs are clothed sparingly with short spinous setæ. The terminal claw is long and there are no auxiliaries.

17. iv. 02. 385 m.

Nymphon tenuimanum.

Body not so much as slender, the lateral processes are widely separated. The ocular tubercle is reduced to a trace, and there are no eyes. The legs are provided with extraordinarily long setæ on the first tibiæ, and to a less extent on the second and the femora. No auxiliary claws.

30. iii. 03. 330 m.

Nymphon exiguum.

Body comparatively stout, with widely separated lateral processes. Ocular tubercle placed well forwards and small; eyes well developed in some specimens.

The joints of the palps are as 3—5—1·3—4.

Propodus twice as long as tarsus. No auxiliary claws. A small species.

Various dates, in 385 m.

Nymphon fuscum.

Nymphon fuscum, Hoek, 'Challenger.'

Several specimens occur in the collection from Kerguelen Island.

This and its allies, *N. antarcticum* of Miers and *N. meridionalis* of Hoek, are very perplexing species. In *N. fuscum*

the range of variation is great, the ocular tubercle differs in most of the specimens, the length of the tarsus and propod is variable even in the same individual, but the differences are not very great and the relations between the two joints are approximately preserved. The setose character of the limbs is accentuated in some specimens. On the whole, *N. antarcticum*, Miers, only differs in that the tarsus is distinctly longer than the propodus.

In *N. meridionale* I find it even more difficult to decide.

CHÆTONYMPHON.

Chætonymphon villosum.

Chætonymphon villosum, Hodgson, 'Discovery.'

This is a stoutly built species, with the lateral processes close together and long coarse setæ distributed over the body and especially on the tibia. The three terminal joints of the palps 6—2—3.

Specialized spines on the ovigers are few in number and have 5—7 teeth. The auxiliary claws are small but distinct, the propodus is longer than the tarsus.

31. xii. 02. 385 m.

One specimen.

Chætonymphon polare.

Another stoutly built species, with lateral processes distinctly separated and fringed with spines. Several spinous setæ fringing each segment.

Palps, three terminal joints as 6—2·75—3·5.

Oviger: specialized spines few, each with 5 or 6 lateral teeth.

Legs armed with spines arising from dermal papillæ.

Propodus shorter than tarsus, auxiliary claws small.

7—8. ii. 03. 350 m.

Chætonymphon longisetosum.

Body with narrowly separated lateral processes, imperfect segmentation, and long setæ.

Palp, three terminal joints 5—1·8—2·75.

Very long setæ on the principal joints of the leg, a very definite specific character.

Propodus longer than tarsus, auxiliary claws small.

14—16. vi. 1902. 385 m.

Chætonymphon typhlops.

Body stout and entirely clothed with fine, as well as coarse setæ; the latter are arranged in a linear manner on the limbs, for the most part on raised papillæ. There are no eyes, but the ocular tubercle exists as a short cone.

This species belongs to the group in which the tarsus is longer than the propodus.

Auxiliary claws are absent.

A few specimens were taken on 1. iii. 03 in 1207 m.

AUSTROPALLENE.

A genus established to include those forms which Möbius, Prof. Bouvier, and the present writer have included in different genera—*Pseudopallene*, *Cordylochele*. The presence of cephalic spurs is a most noticeable feature and is confined to all these southern species.

Body robust or slender, segmentation distinct, lateral processes close together or widely separated. Large and stout cephalic spurs. Eyes well developed. Proboscis tapering, with or without a setose wreath. Cheliferi stout, chelæ short and powerful. Palps no trace. Ovigera 10-jointed, without a terminal claw. In the male a distal swelling on the fifth joint.

No auxiliary claws.

Austropallene cornigera.

Pseudopallene cornigera, Möbius, Pycnogonida of the 'Valdivia' Expedition.

This species I consider to be identical with my *Pseudopallene australe*.

The 'Gauss' found several specimens in their winter-quarters.

Austropallene cristata.

Pseudopallene cristata, Bouvier, 'Pourquoi Pas.'

This species is readily distinguished from all others, even at a very early age, by the extraordinary development of papillæ on the legs, each bearing a spinous seta.

Several specimens at winter-quarters.

Austropallene spicata.

A readily distinguishable species, comparatively slender, with widely separated lateral processes bearing spurs distally,

and having a similar pair, but much larger ones, on the first coxæ; the second coxæ are extremely long. *A. brachyura*, Bouvier, is closely allied, but stouter; lateral processes closer together, and the neck is shorter.

Several specimens, winter-quarters.

Phoxichilidium australe.

The presence of a small process or spur on either side of the proboscis serves to distinguish this species.

A few specimens from winter-quarters.

Pallenopsis pilosa.

Phoxichilidium pilosum, Hoek, 'Challenger' Report.

This species, first described by Dr. Hoek, has since been found at various points in the antarctic regions by most of the recent expeditions.

Winter-quarters, 20. iii. 02.

Pallenopsis vanhoffeni.

This species is conspicuously setose, but readily distinguishable from the foregoing by the coarseness of the setæ. The cephalic segment is longer than the two following. The abdomen is shorter than the first segment and clavate, with a group of long setæ.

Three specimens, winter-quarters, 7. ii. 03 and 3. iv. 02.

Pallenopsis gaussiana.

This may fairly be called a conspicuously setose species, and the distinctive feature is the presence of a spine near the antero-lateral margin of the cephalon. Spines also occur on the lateral processes. The abdomen is longer than the first segment. The legs are clothed with long coarse setæ, but these vary greatly in length.

7. iv. 02.

Pallenopsis meridionalis.

Body with widely separated lateral processes, which, with the first coxæ, bear small spines. Segmentation fairly distinct. Long, coarse, and curved setæ are scattered along the legs, chiefly dorsally.

Winter-quarters, 7. iv. 02.

Pallenopsis setigera.

Another conspicuously setose species. Body stout, segmentation indistinct, spines on lateral processes, limbs coarsely setose, with a series of stout spines on the propodus; terminal claw powerful, with strong auxiliaries. Oviger club-shaped. Seven joints existing.

Winter-quarters, 7. iv. 02.

Pallenopsis spicata.

Not conspicuously setose. Body slender, scarcely so much as widely separated lateral processes. Three doubly pointed tubercles in the mid-dorsal line; tubercles also occur on the lateral processes and the first coxæ. Oviger club-shaped. Seven joints existing.

With regard to the ovigers, these last two species are peculiar.

Winter-quarters, 8. xii. 02.

AMMOTHEA.

This genus now has a different character to that formerly recognized. Dr. J. C. C. Loman has called attention to the type-specimen of Leach now preserved in the British Museum, *A. carolinensis*. This species becomes the type of the genus, and, if bodily form means anything, those diminutive species with a discoid body must be transferred elsewhere.

Ammothea is now that which in my 'Discovery' Report I described as *Leionymphon*, with subsequent additions.

Ammothea glacialis.

Leionymphon glaciale, Hodgson, 'Discovery.'

A single adult female.

26. vii. 02. 385 m.

Ammothea meridionalis.

Body short, with lateral processes close together and lightly tuberculated. Transverse ridges produced in the mid-dorsal line into conspicuous points. Entire body clothed with numerous short stiff setæ; the largest, those on the limbs, are arranged linearly, and the dorsal rows are large on the three principal joints.

Terminal claw long and the auxiliaries more than half the size.

Winter-quarters, 28. xi. 02. 385 m.

ACHELIA.

This genus has been restored from oblivion to include those forms with a discoid body, a more or less imperfect segmentation, with short and stout legs, hitherto included in *Ammothea*.

Achelia megacephala.

Body discoid, smooth. Abdomen very long and cephalon broad. Ocular tubercle stout, erect, with well-developed eyes.

Winter-quarters, two specimens.

AUSTROTHERA.

A new genus designed for those Ammotheid species whose body is not discoid in any sense of the term, and is without the transverse ridges so characteristic of *Ammothea* in its new signification; also the comparatively long legs is a further character of importance.

Austrothea spicata.

Body stout, divergent lateral processes, the proboscis ovate, slender, and the abdomen nearly as long. Ocular tubercle tall, terminating in a long spike.

8. ii. 03. 380 m.

A single specimen only.

Austrothea germanica.

Insignificant spurs on the lateral processes and more conspicuous ones on the first coxæ. Ocular tubercle elongate, pointed, and directed forwards.

16. vi. 02. 385 m.

A single specimen only.

Austrodecus glaciale.

Austrodecus glaciale, Hodgson, 'Discovery.'

A large number of specimens of this species were taken throughout the stay of the 'Gauss' in winter-quarters.

Austroraptus polaris.

Austroraptus polaris, Hodgson, 'Discovery.'

Described from two specimens from the Ross Sea, it now turns up off Kaiser Wilhelm's Land.

10. ii. 02. 385 m.

Tanystylum stylicherum.

Nymphon stylicherum, Miers, Ann. & Mag. Nat. Hist. (4) xvi. (1875).
Tanystylum stylicherum, Miers, Phil. Trans. vol. 168 (1879).

A number from Kerguelen Island.

Rhynchothorax australis.

Rhynchothorax australis, Hodgson, 'Discovery.'

Described by me from a single specimen taken by the 'Discovery' in the Murdo Sound. A very large number were taken by the 'Gauss' throughout its stay in winter-quarters. These reveal the fact that the close approximation of the origin of the lateral processes is simply a sexual matter; in the males they are almost, if not quite, widely separated. From the number obtained it is not a little surprising that none of them carry any eggs or young.

Pycnogonum gaini.

Pycnogonum gaini, Bouvier, 'Pourquoi Pas.'

Of this fine species three adult specimens occur in the 'Gauss' collection, together with a number of postlarval forms.

Its specific character is the existence of four mid-dorsal tubercles, three of them the exaggerated apices of as many transverse ridges and tubercles on the lateral processes.

Winter-quarters.

Besides the foregoing antarctic species, the two following were obtained by the 'Gauss' in temperate or tropical climes:—

Tanystylum paulovensis.

Body discoid, smooth; proboscis very stout, tapering, and nearly as long as body.

Cheliferi reduced to two minute spinose stumps.

St. Paul Island; two specimens.

Anoplodactylus maritimus.

Lateral processes scarcely so much as widely separated. Abdomen short and directed upwards. Ocular tubercle truncate; eyes well developed. Leg: femur the longest joint, the second tibia a little shorter, and the first still shorter—differences small.

Sargasso Sea; a few specimens.

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IX.—On the Swamp-Rats (*Otomys*) of East Africa.

By GUY DOLLMAN.

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IN the following revision of the East-African swamp-rats it has been found necessary to modify considerably the arrangement adopted by Wroughton in his 1906 paper*. The forms *tropicalis*, *nyikae*, *angoniensis*, *orestes*, and *denti* are here raised to full specific rank, *tropicalis* taking the place of *irroratus*, which species, on account of its cranial structure and lamina formula, is not considered a near enough relative for the name to be used in connection with the East-African forms; in this manner we confine *irroratus* and its subspecies to the country south of the Zambesi. As subspecies of *tropicalis* we then have *elgonis* and two new forms from the Jombeni Hills and Mt. Nyiro. In this paper descriptions are given of seven new *Otomys*, all from British East Africa and Uganda.

Key to the Species and Subspecies.

A. Lower incisors with one deep groove.

Ventral surface of tail dark.

*a. m*³ with 5 laminae. (Ruwenzori East.) (1) *denti*, Thos.

* Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 264 (1906).

- b. m*³ with 6 laminæ. (Mt. Mikenö, Congo Belge.) (2) *kempi*, sp. n.
- B. Lower incisors with one deep outer groove and one very shallow inner groove. Ventral surface of tail light.
- a.* Skull of arched appearance, interorbital region raised up and nasals and brain-case markedly depressed.
- a'. m*³ with 7 laminæ.
- a*². Size larger; hind foot 30 mm. in length. (Molo, B.E.A.) (3) *thomasi*, Osg.
- b*². Size smaller; hind foot less than 30 mm. in length.
- a*³. Colour of dorsal surface pale ochreous buff. (Lake Olbolossat, B.E.A.) (4) *t. malleus*, subsp. n.
- b*³. Colour of dorsal surface brownish buff. (Aberdare Mts., B.E.A.) (5) *t. squalus*, subsp. n.
- b'. m*³ with 6 laminæ.
- a*². Colour of dorsal surface brownish buff. Size of molars larger (alveolar length 9.1 mm.). (Teliki Valley, Mt. Kenya, B.E.A.) (6) *orestes*, Thos.
- b*². Colour of dorsal surface dark tawny olive. Size of molars smaller (alveolar length 8.1 mm.). (Mt. Gargues, B.E.A.) (7) *o. dollmani*, Hell.
- b.* Skull without any marked elevation of the interorbital region; general line of brain-case nearly horizontal anteriorly. *m*³ with 7 laminæ.
- a'*. Nasals not exceptionally broad anteriorly (not more than 8 mm. in width).
- a*². Transition from broad to narrow portion of nasals marked by a distinct angle.
- a*³. Size larger; hind foot 27 mm. or more in length, greatest length of skull 40 mm. or more.
- a*⁴. Hindfoot 28-30 mm. in length. Colour rich russet-brown. (West slope, Mt. Kenya.) .. (8) *tropicalis*, Thos.
- b*⁴. Hind foot 27 mm. in length. Colour dark sepia-brown. (Elgoni, Mt. Elgon.) (9) *t. elgonis*, Wrought.
- b*³. Size smaller; hind foot 26 mm. in length. Greatest length of skull less than 40 mm. (Mt. Nyiro, S. of Lake Rudolf.) .. (10) *t. vivax*, subsp. n.
- b*². No angular transition between broad and narrow portion of nasals. General colour very dark. (Jombeni Range, N.E. of Mt. Kenya, B.E.A.) (11) *t. nubilus*, subsp. n.

- b*¹. Nasals very broad anteriorly (more than 8 mm. in width).
*a*². Transition from broad to narrow region marked by a distinct angle.
*a*³. Size larger; hind foot 34 mm. in length, greatest length of skull 46 mm. (Kagambah, Uganda.) (12) *rubeculus*, sp. n.
*b*³. Size smaller; hind foot 26·3 mm. in length, greatest length of skull 39 mm. (Rombo, Kili-manjaro.) (13) *divinorum*, Thos.
*b*². No angular transition between broad and narrow portions of nasals.
*a*³. Size larger; greatest length of skull 40 mm. or more.
*a*⁴. General colour brownish rufous mixed with buff. (M'Kombhuie, Angoniland.) (14) *angoniensis*, Wrought.
*b*¹. General colour olive-grey washed with brown. (Naivasha, B.E.A.) (15) *a. classodon*, Osg.
*b*³. Size smaller; greatest length of skull less than 40 mm. Nasals very short.
*a*⁴. Colour rufous brown speckled with buff. (Nyika Plateau, N. Nyasa.) (16) *nyikæ*, Wrought.
*b*¹. Colour olive-grey tinted with buff. (Kijabe, Naivasha District, B.E.A.) (17) *n. canescens*, Osg.
C. Lower incisors with two deep grooves. Ventral surface of tail light.
a. Skull arched; interorbital region raised up; nasals and brain-case depressed.
*a*¹. *m*³ with 6 laminæ. (East Ruwenzori.) (18) *dartmouthi*, Thos.
*b*¹. *m*³ with 7 laminæ.
*a*². Size smaller; greatest length of skull 35·7 mm. General colour blackish brown. (Mt. Elgon.).. (19) *jacksoni*, Thos.
*b*². Size larger; greatest length of skull 39·7 mm. General colour bright yellowish buff suffused with brown. (12 miles S. of Lake Olbollossat.) (20) *percivali*, sp. n.
*c*¹. *m*³ with 8 laminæ. (Shoa, Abyssinia.) (21) *typus*, Heng.
b. Skull not arched; *m*³ with 9 laminæ. (Charada, Kaffa.) (22) *fortior*, Thos.

DIVISION A.

Lower incisors with only one very deep groove. General colour very dark; ventral surface of tail dull black.

Group 1.

m^3 with 5 laminæ.

(1) *Otomys denti*, Thos.

Otomys denti, Thos. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 142 (1906).

Lower incisors with only one deep groove, large inner portions terminating in two sharp points, sharper and longer than in the other groups; small outer portions sharply pointed and usually very pale in colour, a feature so marked that the skulls of this group can be immediately recognized. Brain-case flat.

In colour this species is exceedingly dark, the dorsal surface being brownish black ("blackish brown (3)" speckled with "auburn," Ridgway, 1912) speckled with coppery buff. Backs of hands and feet blackish brown. Ventral surface of body slate-black slightly speckled with buff. Tail dull black above and below. With the exception of the following species, all the other East-African *Otomys* have a light under surface to the tail.

Dimensions of the type:—

Head and body 157 mm.; tail 89; hind foot 27; ear 21.

Skull: greatest length 36·7; basilar length 30·2; zygomatic breadth 18·3; breadth of brain-case 15·5; length of nasals 14·7; breadth of anterior expanded portion 7; palatal length 16·8; length of upper molar series from front alveolar border to back of last molar 8·3.

The molars are rather small, m^3 possessing only 5 laminæ.

Hab. Ruwenzori East. Altitude 6000 feet.

Type. Old female. B.M. no. 6. 7. 1. 69.

Externally *denti* and the following species are immediately recognized by their very dark colour and the dark ventral surface of the tail.

Group 2.

m^3 with 6 laminæ.

(2) *Otomys kempi*, sp. n.

Allied to *O. denti*, Thos., but distinguished by m^3 possessing 6 instead of 5 laminæ.

In general dimensions a trifle larger than the Ruwenzori species. The description given above for the colour of *denti*

may be taken for this species also, as in general colour the two forms are exactly the same.

Skull larger and heavier; molars considerably longer, m^3 with 6 well-defined laminae. Lower incisors exactly as in *denti*, i. e., with only one groove.

Dimensions of the type (measured in the flesh):—

Head and body 159 mm.; tail 101; hind foot 28·5; ear 22.

Skull: greatest length 40·5; basilar length 33·3; condylo-incisive length 38·2; zygomatic breadth 21; interorbital constriction 4; squamosal breadth of brain-case 15·7; length of nasals 16·3; greatest width across expanded part of nasals 7; breadth across middle of nasals (taken just behind the anterior expanded portion) 4·7; depth from highest point of orbit to alveolar border at front of m^3 12·2; palatilar length 19·2; length of palatal foramina 7·8; postpalatal length 14·1; length of upper molar series, from anterior alveolar border to back of last molar, 8·9; length from anterior enamel-base of m^1 to back of m^3 8·5; greatest width of m^1 2·5.

Hab. Burunga, Mt. Mikeno, Congo Belge. Altitude 6000 feet.

Type. Old male. B.M. no. 11. 12. 3. 110. Original number 2206. Collected by Mr. Robin Kemp on June 6th, 1911.

The 6 laminae of m^3 immediately separate this form from the Ruwenzori *denti*.

Mr. Kemp obtained in all a dozen specimens of this interesting *Otomys*, six from the type-locality and six from Buhamba, near Lake Kivu, Congo Belge.

DIVISION B.

Lower incisors with one deep outer groove and one very shallow inner groove. Ventral surface of tail light.

Section I.

The members of this section all possess skulls exhibiting a marked arched appearance, the interorbital region being conspicuously elevated and the nasals and brain-case so depressed as to accentuate this humped or arched character. (This condition is also found in Division C, Section I.)

Group 1.

m^3 with 7 laminae.

(3) *Otomys thomasi*, Osg.

Otomys thomasi, Osg. Field Mus. Nat. Hist. Publication, 141, Zool. Ser. vol. x. no. 2, p. 9 (1910).

This species is immediately known by its curious arched

or "humped" skull, the interorbital region being raised up into a regular hump, from which point the nasals slope markedly downwards anteriorly, and similarly the cranial region posteriorly, the interorbital or frontal angle so formed being most conspicuous; owing to this feature the depth from the highest point of the orbit to the alveolar border is very great. The general colour is given by Osgood as "from pale cinnamon to wood-brown"; specimens in the Museum Collection identified by the describer seem to agree with this description quite closely. Behind the ears is a conspicuous patch of creamy buff, a feature well developed in the following race. Hands and feet creamy buff. Underparts slate-grey washed with brown.

Skull: in addition to the curious arched character mentioned above, the nasals are rather narrow posteriorly, of the same spoon-shaped pattern as those of *tropicalis*. m^3 with 7 laminae.

Dimensions of the type (measured in the flesh):—

Head and body 184 mm.; tail 98; hind foot 30.5; ear 24.

Skull: greatest length 43.3; basilar length 34.6; zygomatic breadth 21.7; length of nasals 20.7; greatest breadth of nasals 7.5; interorbital constriction 3.4; depth from highest point of orbit to alveolar border at front of m^3 14.5; postpalatal length 15.1; palatal foramina 7.5; length of upper molar series 9.2; greatest width of m^1 2.5.

Hab. Molo, British East Africa.

Type. Adult female. In Field Museum of Natural History, no. 16698.

(4) *Otomys thomasi malleus*, subsp. n.

Allied to *O. thomasi*, Osg., smaller in size and paler in colour.

General proportions conspicuously less than in *thomasi*. Colour of dorsal surface pale ochreous buff suffused with brownish on the back, the general effect paler and greyer than in the Molo form. Flanks pale buff. Head and muzzle similar in colour to back, cheeks pale buff. Light areas behind ears much as in *thomasi*, but not so prominent. Backs of hands and feet light greyish white washed with pale buff. Underparts of body slate-grey overlaid with pale buff. Tail greyish white tinted with buff.

Skull of the same arched type as that of *thomasi*, but decidedly smaller and with much shorter nasals.

Dimensions of the type (measured in the flesh):—

Head and body 150 mm.; tail 81; hind foot 26; ear 23.

Skull: greatest length 37·8; basilar length 30; condylo-incisive length 35·4; zygomatic breadth 19·5; interorbital constriction 4·4; length of nasals 16·8; greatest breadth across expanded part of nasals 6·5; depth from highest point of orbit to alveolar border at front of m^3 13·3; length of palatal foramina 6·9; postpalatal length 13·6; length of upper molar series from anterior alveolar border to back of last molar 9·5; length from anterior base of enamel on m^1 to back of m^3 8·6; greatest width of m^1 2·3.

Hab. Lake Olbollossat, Naivasha Province, British East Africa.

Type. Adult female. B.M. no. 12. 7. 1. 431. Original number 79. Collected and presented by A. Blayney Percival, Esq.

This *Otomys* is evidently quite closely allied to the Molo species; the difference in size and much paler colour are the chief distinguishing characters. That a race of the Molo species should occur at Olbollossat is not surprising when the geographical conditions are considered.

Mr. Percival collected two further specimens of this *Otomys* at the type-locality; the dimensions are given as: head and body 150, 143 mm.; tail 86, 82; hind foot 26, 26. The skulls both show the same curious arched formation, the interorbital region being considerably elevated and the nasals and cranial outline depressed.

(5) *Otomys thomasi squalus*, subsp. n.

Size rather larger than in the foregoing race, colour considerably darker and richer.

Size of body greater than in *t. malleus*, but markedly less than in *thomasi*. General colour of dorsal surface a rich brownish buff, the effect much darker and browner than in *malleus*. Flanks not conspicuously lighter than back. Sides of face and head similar in colour to back, without any prominent light areas behind the ears. Backs of hands and feet white, washed with pale buff. Underparts of body rather darker throughout. Tail as in the other members of this group.

Skull a trifle larger than that of *malleus*, with broader nasals and longer palatal foramina. Cranial dimensions considerably less than in *thomasi*.

Dimensions of the type (measured in the flesh) :—

Head and body 166 mm.; tail (broken) *; hind foot 26·5; ear 21.

Skull: greatest length 40; basilar length 31·9; condylo-incisive length 36·7; zygomatic breadth 20·7; interorbital constriction 3·8; length of nasals 18·2; greatest breadth across expanded part of nasals 7·3; depth from highest point of orbit to alveolar border at front of m^3 13·6; length of palatal foramina 7·5; postpalatal length 14·2; length of upper molar series from anterior alveolar border to back of last molar 9·5; length from anterior base of enamel on m^1 to back of m^3 8·8; greatest width of m^1 2·5.

Hab. Mt. Kinangop, Aberdare Range, British East Africa. Altitude 12,000 feet.

Type. Old male. B.M. no. 10. 5. 3. 41. Original number 713. Collected by Mr. Robin Kemp on February 27th, 1910, and presented to the British Museum by Mr. C. D. Rudd.

The smaller size of this Aberdare *Otomys* immediately separates it from the large Molo form, while the darker and richer colour of the fur serve to distinguish it from *malleus*.

Mr. Kemp collected four specimens of this *Otomys* from localities on the Aberdare Mountains ranging between 10,000 and 12,000 feet in altitude; all four specimens are exactly similar in general colour. This must be regarded as a mountain race of *thomasi*.

Group 2.

m^3 with only 6 laminæ.

(6) *Otomys orestes*, Thos.

Otomys irroratus orestes, Thos. P. Z. S. 1900, p. 175.

The skull in this species exhibits the same striking arched appearance as is seen in *thomasi* and the allied races described above. The last upper molar, however, only possesses 6 laminæ.

In general colour *orestes* is rather similar to the Aberdare race of *thomasi* described above as *T. squalus*; the dorsal surface is rather richer and browner, but otherwise there is very little difference.

Dimensions of the type :—

Head and body 175 mm.; tail 62; hind foot 27; ear 20·5.

* In another specimen from the type-locality the tail is given as 88 mm. in length.

Skull: greatest length 38·6; basilar length 31; zygomatic breadth 20; breadth of brain-case 16·5; length of nasals 17; greatest width across expanded portion 7·1; depth from highest point of orbit to alveolar border at front of m^3 13·2; palatilar length 17; length of upper molar series from front alveolar border to back of m^3 9·6.

Hab. Teliki Valley, west slope of Mt. Kenya. Altitude 13,000 feet.

Type. Old male. B.M. no. O. 2. 1. 21.

(7) *Otomys orestes dollmani*, Hell.

Otomys orestes dollmani, Heller, Smith. Misc. Coll. vol. lix. no. 16, p. 5 (1912).

Agrees with *orestes* in that m^3 possesses only 6 laminæ, but skull less arched and narrower, with smaller bullæ and teeth, and pelage considerably darker in colour.

The specimens of this Gargues (Urguess) *Otomys* collected by Mr. Blayney Percival are, unfortunately, too young to be of any systematic use.

In colour this race would appear to be similar to *tropicalis*, *i. e.*, a rich tawny olive above and slate-grey suffused with brownish buff below.

The dimensions given by Heller are:—

Head and body 150 mm.; tail 88; hind foot 25; ear 21.

Skull: greatest length 37·4; basilar length 29·2; zygomatic breadth 18·1; interorbital constriction 4·9; nasals 17·2 × 7; postpalatal length 12; length of upper molar series (alveolar) 8·1.

Mr. Heller, when describing this form, mentioned that he had five specimens from the type-locality all agreeing in laminar formulæ, *i. e.*, m^3 with only 6 laminæ.

Hab. Mt. Gargues (Mt. Urguess). Altitude 7000 feet.

Section II.

Skulls without any marked elevation of the interorbital region, the general line of the brain-case nearly horizontal anteriorly. m^3 with 7 laminæ.

Group 1.

Nasals not exceptionally broad anteriorly (not more than 8 mm. in width); transition from broad to narrow region marked by a distinct angle, resulting effect rather spoon-shaped.

(8) *Otomys tropicalis*, Thos.

Otomys irroratus tropicalis, Thos. Ann. & Mag. Nat. Hist. (7) vol. x. p. 314 (1902).

A dark brownish-buff-coloured species, distinguished from

the *angoniensis* and *nyikae* groups by the shape of the nasals, the expanded portion of which never exceeds 8 mm. in width, and the transition to the narrower part marked by a more distinct angle than in the Nyasa forms.

Size fairly large, hind foot generally about 28–30 mm. in length.

Colour of dorsal surface rich russet-brown lined with black and buff; flanks rather paler. Sides of face and muzzle strongly tinted with buff. Backs of hands and feet dirty brownish buff. Ventral surface of body slate-grey washed with buff. Tail dark brown above, dirty cream-colour below.

Skull large; nasals somewhat spoon-shaped, the expanded anterior portion narrowing rather abruptly, with a marked constriction just behind the expanded area. Molars fairly large; m^3 with 7 laminæ.

Dimensions of the type:—

Head and body 180 mm.; tail 80; hind foot 30; ear 23.

Skull: greatest length 44; basilar length 35.4; zygomatic breadth 21.6; breadth of brain-case 16.5; length of nasals 18.5; breadth across expanded portion 7.8; breadth across middle of nasals, just behind the constriction, 4; depth from highest point of orbit to alveolar border at front of m^3 13.3; palatilar length 19.7; length of upper molar series from front alveolar border to back of m^3 10; crowns 9.

Hab. West slope of Mt. Kenya. Altitude 10,000 feet.

Type. Old male. B.M. no. O. 2. 1. 20.

In the Museum Collection are a great number of specimens referred to this species; it would seem to extend northwards as far as the Aberdare Mountains, where gradually the race known as *elgonis* begins to become dominant. South of Kenya it seems to be rather rare.

(9) *Otomys tropicalis elgonis*, Wrought.

Otomys irroratus elgonis, Wrought. Ann. & Mag. Nat. Hist. (8) vol. v. p. 207 (1910).

A dark race of *tropicalis*.

General dimensions rather smaller than in the typical *tropicalis*.

Colour like that of the Kenya species, but darker and richer. Flanks, sides of face, muzzle, and entire underparts considerably darker.

Skull same as in *tropicalis*, but rather smaller.

Dimensions of the type:—

Head and body 165 mm.; tail 81; hind foot 27; ear 21.

Skull: greatest length 41; basilar length 34; zygomatic breadth 20·3; breadth of brain-case 16·3; length of nasals 18; breadth across expanded portion 7·4; depth from highest point of orbit to alveolar border at front of m^3 12·4; palatilar length 18·7; length of upper molar series from front alveolar border to back of m^3 10.

Hab. Elgonyi, Mt. Elgon. Altitude 7000 feet.

Type. Adult male. B.M. no. 10. 4. 1. 78.

(10) *Otomys tropicalis vivax*, subsp. n.

Allied to *O. t. elgonis*, but smaller in size and considerably paler in colour.

Dimensions of head and body markedly less than in the Elgon form; tail rather long.

General colour of dorsal surface much paler and more suffused with light brownish buff, lacking the dark wash which is the dominant note in the colouring of *elgonis*. Flanks and sides of head rather lighter and more buff-coloured than back. Muzzle and sides of face bright buff. Backs of hands and feet dirty brownish buff. Under parts of body pale slate-grey overlaid with bright creamy buff, the general effect much lighter and more buff-coloured than in the Elgon race.

Skull considerably smaller with much smaller teeth. Nasals very much as in *elgonis*, the subterminal constriction not quite so well defined. The lamina formula as in *tropicalis*, but the last lamina of m^3 is very small and not entirely separated from the 6th.

Dimensions of the type (measured in the flesh):—

Head and body 147 mm.; tail 83; hind foot 26; ear 21.

Skull: greatest length 38·4; basilar length 30·5; condylo-incisive length 35·3; zygomatic breadth 19·3; inter-orbital constriction 4·2; length of nasals 16·6; greatest width across expanded part of nasals 7; depth from highest point of orbit to alveolar border in front of m^3 11·8; length of palatal foramina 7; postpalatal length 13·7; length of upper molar series from anterior alveolar border to back of last molar 9; length from anterior base of enamel on m^1 to back of m^3 8·3; greatest width of m^1 2·2.

Hab. Mt. Nyiro, south of Lake Rudolf, East Africa. Altitude 8000 feet.

Type. Adult female. B.M. no. 12. 7. 1. 425. Original number 391. Collected by A. Blayney Percival, Esq., on March 24th, 1911, and presented by him to the British Museum.

The chief characters that separate this Nyiro *Otomys* from the Elgon race are its smaller size, smaller teeth, and very much paler-coloured pelage.

Group 2.

Nasals not exceptionally broad (not more than 8 mm. in width), but showing no angular transition between the broad and narrow portions, pattern rather trumpet-shaped.

(11) *Otomys tropicalis nubilus*, subsp. n.

A very dark race, related to *elgonis* and *tropicalis*.

Size and general proportions as in *elgonis*.

Colour of dorsal surface dark sepia-brown speckled with buff, the general effect is very nearly as dark as in *denti* and the allied species *O. kempi*; both *elgonis* and *tropicalis* are considerably lighter in colour. Flanks rather more thickly speckled with buff. Backs of hands and feet as in *elgonis*, ventral surface of body slate-black speckled with pale buff, the whole a shade darker than in the Elgon form.

Skull about equal in size to that of *elgonis*, but distinguished by the shape of the nasals which do not show any sudden subterminal constriction, the expanded anterior portion narrowing gradually without the angular compression so conspicuous in *elgonis* and *tropicalis*. The general appearance of the nasals is rather that of a very narrow example of the *angoniensis* pattern. The inner groove of the lower incisors in this form is fairly well developed, more so than in *tropicalis*, where the inner groove is no more than a very shallow depression. In *elgonis* there would seem to be a certain amount of variation as regards the development of this inner groove, in the type-specimen it is fairly well formed, while in others from the type-locality this groove is very indistinct. The molars are quite like those of *tropicalis* and *elgonis*, m^3 having seven laminæ.

Dimensions of the type (measured in the flesh):—

Head and body 170 mm.; tail 80; hind foot 28·5; ear 20.

Skull: greatest length 41·5; basilar length 33·7; condylo-incisive length 38·5; zygomatic breadth 19·5; inter-orbital constriction 4·7; breadth of brain-case 16; greatest length of nasals 17; greatest anterior width of nasals 7·7; median width 4·1; palatilar length 19; length of palatal foramina 8; length of upper molar series from anterior alveolar border to back of last molar 10; width of m^1 2·7.

Hab. Jombeni (Igambi) Range, N.E. of Mt. Kenya. Altitude 6000 feet.

Type. Adult male. B.M. no. 11. 12. 2. 4. Original number 1918. Collected by Mr. Robin Kemp on February 15th, 1911.

The very much darker-coloured pelage and less abruptly narrowing nasals distinguish this form from *elyonis* and *tropicalis*.

In addition to the four specimens collected by Mr. Kemp on the Jombeni Range, this form has also been obtained by Mr. Percival on the Larrogie Mountains (altitude 7700 feet) north of the Northern Guaso Nyiro, and at Mweru (4500 feet), and on the Embu Road (4000 feet).

O. orestes dollmani, its near neighbour, is immediately distinguished by the fact that there are only six laminae in m^3 , while the Jombeni race possesses the same lamina formula as the *tropicalis* group, i. e. $\frac{3 \cdot 2 \cdot 7}{4 \cdot 2 \cdot 2}$.

Group 3.

Nasals very broad anteriorly (more than 8 mm. in width), transition from broad to narrow region marked by a distinct angle.

(12) *Otomys rubeculus*, sp. n.

A very large species related to *tropicalis*.

Size considerably greater than in any other East African species, head and body measuring 201 mm. in length and the hind foot 34.

General colour very much as in *angoniensis*, dull brown lined with buff. Face and sides of head less richly tinted with buff; orange rings around eyes absent. Ventral surface of body much as in *tropicalis*. Tail very long, dull brownish black above, dirty cream-coloured below.

Skull very large and massive. Nasals very broad in front, the transition to the narrow portion marked by a fairly distinct angle, much more so than in *angoniensis* or *nyikæ*. Brain-case very broad; general outline of cranium nearly horizontal. Auditory bullae exceptionally prominent. Teeth large; m^3 with 7 laminae.

Dimensions of the type (measured in the flesh):—

Head and body 201 mm.; tail 112; hind foot 34; ear 25.

Skull: greatest length 46·2; basilar length 37; zygomatic breadth 22; breadth of brain-case 18·2; greatest width across nasals 9; width at constriction behind anterior expansion 5·2; depth from highest point of orbit to alveolar border at front of m^3 15·3; palatilar length 21; length of palatal foramina 9; length of upper molar series from front alveolar border to back of m^3 11; crowns 9·3.

Hab. Kagambah, Uganda. Altitude 4800 feet.

Type. Old male. B.M. no. 11.12.3.87. Original number 2343. Collected by Mr. Robin Kemp on July 10th, 1911.

The great size of this species renders it easily distinguishable from all the other East African *Otomys*.

Mr. Kemp obtained two further specimens of *rubeculus* at Nalasanji, Uganda, both of which, though subadult, are almost equal in size to the type.

(13) *Otomys divinatorum*, Thos.

Otomys divinatorum, Thos. Ann. & Mag. Nat. Hist. (8) vol. vi. p. 311 (1910).

This species is apparently intermediate between the *tropicalis* and *angoniensis* groups, possessing the broad nasals of *angoniensis*, which, however, exhibit the same angular transition to the narrower part as is found in *tropicalis*.

Size rather smaller than in *tropicalis*.

Colour considerably paler than in the Kenya species, the whole dorsal surface being of a uniform cinnamon-brown and lacking the rather coarsely lined appearance of *tropicalis* and *angoniensis*. Muzzle and light rings around eyes bright orange-buff. Ventral surface of body slate-grey washed with brownish buff.

Skull rather smaller than that of *tropicalis* or *angoniensis*. Nasals very broad anteriorly, the transition to the narrower posterior portion marked by a distinct angle. We thus have a combination of the broad nasals of *angoniensis* and the spoon-shaped pattern of *tropicalis*. Molars rather small, m^3 with 7 laminae.

Dimensions of the type:—

Head and body 173 mm.; tail 80; hind foot 26.3; ear 22.

Skull: greatest length 39; basilar length 31.7; zygomatic breadth 20.3; nasals 17.6×9 ; depth from highest point of orbit to alveolar border at front of m^3 12.8; length of upper molar series (crowns) 8.4; breadth of m^1 2.2.

Hab. Rombo, Kilimanjaro. Altitude 5300 feet.

Type. Adult female. B.M. no. 10.7.2.84.

This species is only known from the type-specimen; all the other *Otomys* collected by Mr. Kemp at Rombo were *O. angoniensis classodon*.

Group 4.

Nasals very broad anteriorly (more than 8 mm. in width), without any sudden angular transition between the broad and the narrow portions.

(14) *Otomys angoniensis*, Wrought.

Otomys irroratus angoniensis, Wrought. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 274 (1906).

A large species with very broad nasals, which narrow more gradually than in the *tropicalis* group, the pattern more trumpet-shaped than spoon-shaped. In *tropicalis* and its allies there is usually a sharp constriction just posterior to the expanded portion; in *angoniensis* there is no such constriction, the sides of the nasals forming a simple trumpet-shaped design, without the well-marked "neck" seen in *tropicalis*.

General colour rather like that of *tropicalis*, but more coarsely lined with buff. Ventral surface of body strongly tinged with buff.

Skull about equal in size to that of *tropicalis*; nasals broadly expanded in front and narrowing gradually behind.

Dimensions of the type (from dried skin):—

Head and body 175 mm.; tail 90; hind foot 30; ear 21.

Skull: greatest length 42; zygomatic breadth 20; breadth of brain-case 15·6; length of nasals 19·7; greatest width across nasals 8·9; depth from highest point of orbit to alveolar border at front of m^3 13·9; palatilar length 19; length of upper molar series from front alveolar border to back of m^3 10·7.

Hab. M'Kombluie, Angoniland, Nyasa. Altitude 8000 feet.

Type. Adult female. B.M. no. 2.1.6.22.

This species may be known by its long and broadly expanded trumpet-shaped nasals.

In the Museum collection are several specimens from the type-locality and a few from the Shire Highlands and Zomba, S. Nyasaland, all referable to *angoniensis*.

(15) *Otomys angoniensis elassodon*, Osg.

Otomys angoniensis elassodon, Osgood, Field Mus. Nat. Hist. Publication, 141, Zool. Ser. vol. x. no. 2, p. 10 (1910).

Related to *O. angoniensis*, rather smaller in size and paler and greyer in colour.

General proportions rather less than in the Nyasa species.

Colour olive-grey mixed with brown, the striking rufous tint of *angoniensis* absent; buff colour on belly considerably paler.

Skull rather smaller and narrower, nasals broadly expanded anteriorly, as in *angoniensis*; teeth slightly smaller, m^3 with 7 laminæ.

Dimensions of the type (as given by Osgood):—

Head and body 183 mm.; tail 87; hind foot (c. u.) 29; ear 21.

Skull: greatest length 41; basilar length 34.3; zygomatic breadth 21; length of nasals 17.7; greatest breadth across nasals 8.9; depth from highest point of orbit to alveolar border at front of m^3 13.8; postpalatal length 15; maxillary tooth-row 8.2 (crowns).

The length of the molar series, from front alveolar border to back of m^3 in a Laikipia specimen in the Museum collection, is 10 mm.

Hab. Naivasha, British East Africa.

This race of *angoniensis* is evidently very widely distributed over British East Africa. In the collection is a large series from Rumruti, Laikipia Plateau, all of which agree fairly closely with Osgood's description. There are also specimens from Nairobi and from as far south as Rombo, Kilimanjaro. The Rombo *Otomys* are for the most part rather smaller than the Rumruti ones, but, as this variation in size is not constant throughout the series, it is impossible to regard it as of systematic value.

This Naivasha form is distinguished from its near neighbour *O. nyikæ canescens* by its larger size and longer skull.

(16) *Otomys nyikæ*, Wrought.

Otomys irroratus nyikæ, Wrought. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 276 (1906).

Rather smaller than *angoniensis*; skull much shorter, with exceptionally broad flat nasals; pattern almost triangular.

General dimensions less than in the southern species; hind foot only 27 mm. in length.

Colour very like that of *angoniensis*; under surface of body washed with brownish buff.

Skull short and stout; nasals very broad and flat, in one specimen the greatest width across the nasals is as much as 10 mm.

Dimensions of the type (from dried skin):—

Head and body 170 mm. (probably not more than 160 mm. in the flesh); tail 70; hind foot 27; ear 20.

Skull : greatest length 38·2* mm. ; basilar length 32 ; zygomatic breadth 19·6 ; breadth of brain-case 15·7 ; length of nasals 18 ; greatest breadth across nasals 9·5 ; depth from highest point of orbit to alveolar border at front of m^3 12·6 ; palatilar length 17·1 ; length of upper molar series from front alveolar border to back of last molar 9·7.

Hab. Nyika Plateau, North Nyasa. Altitude 6000–7000 feet.

Type. Adult male. B.M. no. 97.10.1.107.

Otomys nyikæ is evidently closely related to the South Nyasa species, *O. angoniensis* ; both forms are very similar in general colour, the ventral surface being more strongly tinted with brownish buff in these two *Otomys* than in any of the other East African forms. In size *nyikæ* is rather smaller ; the skulls may be distinguished by the shape of the nasals, those of *nyikæ* being exceptionally broad and flat and comparatively short, while in *angoniensis* they are narrower, rather more curved, and longer,

(17) *Otomys nyikæ canescens*, Osg.

Otomys nyikæ canescens, Osgood, Field Mus. Nat. Hist. Publication, 141, Zool. Ser. vol. x. no. 2, p. 10 (1910).

Agrees with *O. nyikæ* in having a short thick skull with short, very broad nasals.

General colour much paler and greyer ; on the dorsal surface there is an almost entire absence of the russet tint so conspicuous in *nyikæ*, its place being taken by a pale olive-grey wash.

Skull like that of *nyikæ*, with broadly expanded nasals ; teeth fairly large, m^3 with 7 laminæ.

Dimensions of type (as given by Osgood) :—

Head and body 175 mm. ; tail 8½ ; hind foot 29 (c. u.) ; ear 19·5.

Skull : greatest length 37·2 ; basilar length 30·9 ; zygomatic breadth 19·6 ; length of nasals 17·1 ; greatest breadth of nasals 8·5 ; depth from highest point of orbit to alveolar border at front of m^3 12·8 ; postpalatal length 13·8 ; maxillary tooth-row 8·4.

In a specimen from Mt. Suswa, quite close to the type-locality, the upper molar series measures from the front alveolar border to the back of m^3 9 mm. in length.

Hab. Kijabe, Naivasha District, British East Africa.

This race is represented in the collection by specimens

* In Wroughton's original description, the skull-dimensions given are not those of the type.

from the following localities:—Mt. Suswa, Mau, Lemek Valley (Amala District), south side of Aberdare Mountains, Nakuru, and the Larrogie Mountains (N. of Laikipia).

In examining the skins of British East African *Otomys*, it is very easy to mistake *canescens* for small specimens of *angoniensis classodon*, the general colour of the two forms being very alike. The short thick skull of *canescens*, however, is very distinct from the larger and longer skull of *classodon*.

DIVISION C.

Lower incisors with two well-marked deep grooves.
Ventral surface of tail light.

Section I.

Skull showing the same arched or humped appearance as is found in the *thomasi* group, the interorbital region raised up, and the nasals and general line of the brain-case depressed so as to accentuate this arched character.

Group 1.

m^3 with 6 laminæ.

(18) *Otomys dartmouthi*, Thos.

Otomys dartmouthi, Thos. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 141 (1906).

This species stands by itself among the *Otomys* with two deep grooves in the lower incisors, being the only one with 6 laminæ in m^3 .

Externally *dartmouthi* is very distinct, the fur being a great deal more woolly than in any other East African *Otomys*. General colour of dorsal surface pale brown finely speckled with yellowish buff. Backs of hands and feet dirty buff. Ventral surface of body slate-grey washed with buff. Tail rather dark above, almost black; sides and ventral surface buff.

Skull, as in all the members of this division, excepting *fortior*, of the same arched or humped type as is found in the *thomasi* group, but the deep double grooving of the lower incisors immediately distinguishes the skulls of *dartmouthi* and its allies from those of *thomasi* and the other members of that group. Molars fairly large, m^3 with 6 laminæ.

Dimensions of the type:—

Head and body 150 mm.; tail 93; hind foot 26·5; ear 25.

Skull: greatest length 37·6 mm.; basilar length 30·5; zygomatic breadth 19·5; width of brain-case 15·5; length

of nasals 16·5; width across expanded anterior portion 6·8; depth from highest point of orbit to alveolar border at front of m^3 12·5; palatilar length 17; length of upper molar series from front alveolar border to back of last molar 9·5.

Hab. Mubuku Valley, East Ruwenzori. Altitude 12,500 feet.

Type. Adult male. B.M. no. 6. 7. 1. 64.

This species is easily distinguished from the other members of the division by its soft woolly pelage and the presence of only 6 laminae in m^3 ,

Group 2.

m^3 with 7 laminae.

(19) *Otomys jacksoni*, Thos.

Otomys jacksoni, Thos. Ann. & Mag. Nat. Hist. (6) vol. vii. p. 2 (1891).

Otomys jacksoni is distinguished from the other members of the division by its small size; the presence of 7 laminae in m^3 readily separates the *jacksoni* group from *dartmouthi* with only 6 laminae, and from the *typus* or 3rd group with 8 laminae in m^3 .

In size *jacksoni* is smaller than any other East African *Otomys*; both the skin and skull dimensions are remarkably small.

General colour a great deal darker than in the foregoing species, back dark blackish brown mixed with orange-buff, the effect almost as dark as in *t. nubilus* described above. Backs of hands and feet greyish brown.

Skull considerably smaller than in any of the other species treated of in this paper. The arched character is not so accentuated as in *dartmouthi* and the following species, the brain-case not being so depressed posteriorly. Molars rather narrow, m^3 with 7 laminae.

Dimensions of the type:—

Head and body 120 mm.; hind foot 26.

Skull: greatest length 35·7; basilar length 28; zygomatic breadth 18·1; breadth of brain-case 15·5; length of nasals 16; width across anterior expansion 6·8; depth from highest point of orbit to alveolar border at front of m^3 11·2; palatilar length 15·5; length of upper molar series from front alveolar border to back of m^3 9·2.

Hab. Crater of Mt. Elgon. Altitude 13,200 feet.

Type. Adult female. B.M. no. 93. 2. 3. 34.

The small size and dark colour of this Elgon species readily separate it from the other four members of Division C. The *Otomys* obtained by Mr. R. Kemp on Mt. Elgon was a

very different animal, and not in any way closely related to *jacksoni*, a species that is probably only found at the very top of the mountain.

(20) *Otomys percivali*, sp. n.

Agrees with *jacksoni* in that m^3 possesses 7 laminae, but is very much larger in size, paler in colour, and the general form of the skull considerably more arched than in the Elgon species. Size much larger; head and body 160 mm. in length. Colour of dorsal surface bright ochreous buff suffused with brownish, the general effect yellower and brighter than in *dartmouthi*. Flanks rather lighter and yellower than back. Face and head bright yellowish buff. Eyes surrounded with orange-coloured rings. Long hairs in front of ears with dark bases and orange-buff tips; hairs directly behind ears with creamy-white tips, somewhat as in the *thomasi* group. Backs of hands and feet dirty white. Ventral surface of body much as in *dartmouthi*. Tail brownish orange above; dull orange-buff below.

Skull with interorbital region markedly arched, muzzle and cranial lines considerably depressed. Auditory bullae and teeth very much larger than in *jacksoni*; m^3 with 7 laminae and, as in all the other members of this division, the lower incisors marked with two deep grooves, the inner one rather less deeply cut than the outer, but very much more so than in any of the forms in Division B, *i. e.* the *tropicalis*, *thomasi*, and *orestes* groups.

Dimensions of the type (measured in the flesh) :—

Head and body 160 mm.; tail 88; hind foot 27; ear 23.

Skull: greatest length 39·7; basilar length 32·2; condylo-incisive length 37; zygomatic breadth 20·6; interorbital constriction 3·5; squamosal breadth of brain-case 14; length of nasals 17; greatest width across expanded part of nasals 6·5; breadth across middle of nasals (taken just behind the expanded anterior portion) 4; depth from highest point of orbit to alveolar border at front of m^3 13·7; palatilar length 18·1; length of palatal foramina 7; post-palatal length 14·5; length of upper molar series from anterior alveolar border to back of last molar 10·5; length from anterior base of enamel on m^1 to back of m^3 9·5; greatest width of m^1 2·7.

Hab. Twelve miles south of Lake Olbollossat, Naivasha District, B.E.A. Altitude 8700 feet.

Type. Old female. B.M. no. 12. 7. 1. 424. Original number 509. Collected by A. Blayney Percival, Esq., on

June 28th, 1911, and presented by him to the National Collection.

There is no difficulty in distinguishing this new form from the Elgon species; the very much larger size, lighter colour, and more arched skull are characters that at once serve to distinguish *percivali* from *jacksoni*. The lamina formula is sufficient to separate it from *dartmouthi*, *typus*, and *fortior*, while the double grooving of the lower incisors indicates plainly that it cannot be considered a member of the *thomasi* group, with which it has a number of features in common.

Group 3.

m^3 with 8 laminae.

(21) *Otomys typus*, Heug.

Oreomys typus, Heuglin, Reis. N. Ost-Afr. ii. p. 76 (1877).

Otomys degeni, Thos. P. Z. S. 1902, ii. p. 311.

About equal in size to *dartmouthi* and *percivali*; the presence of 8 laminae in m^3 easily distinguishes this Abyssinian species from *dartmouthi*, *jacksoni*, and *percivali*.

In general colour very like *O. t. squalus*, dorsal surface brownish buff; head and flanks strongly tinged with buff, yellow rings around eyes very conspicuous. Backs of hands and feet dirty cream-buff.

Skull arched, but not so markedly as in the last species. Molars large, m^3 with 8 laminae.

Dimensions (from a spirit-specimen):—

Head and body 161 mm.; tail 90; hind foot 28·5; ear 22.

Skull (type of *degeni*): length from back of interparietal to tip of nasals 36·2; greatest breadth 19·7; nasals, greatest length 16·5; greatest breadth across anterior expansion 7·5; palatilar length 17·7; length of palatal foramina 7·4; length of upper molar series from front alveolar border to back of m^3 10·3, crowns 8·2.

Hab. Shoa, Abyssinia.

Thomas has already pointed out* that his *degeni* is identical with *typus* of Heuglin, the original description given by Heuglin being "grossly inaccurate." Wroughton in his paper followed this view, and it seems best to adopt it here. The above description is taken from the type-specimen of *degeni*, which we must now accept as representing *typus*.

* Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 302 (1906).

Section II.

Skull flat, no marked elevation of the interorbital region or depression of the general line of the cranium.

Group 1.

m^3 with 9 laminæ, the last one very small and not entirely separated from the 8th.

(22) *Otomys fortior*, Thos.

Otomys typus fortior, Thos. Ann. & Mag. Nat. Hist. (7) vol. xviii. p. 302 (1906).

Larger than the preceding species with a much flatter skull, the interorbital region showing very little of the characteristic arched appearance seen in the other members of this group; m^3 with 9 laminæ.

In colour this species most nearly resembles *angoniensis*, the yellowish suffusion so evident in *percivali*, and to a certain extent in *typus*, is here almost absent; dorsal surface a uniform brown, lined with buff. Light markings around eyes and ears absent. Backs of hands and feet dirty brown. Under parts slate-grey washed with buff.

Skull, as stated above, without any marked elevation of the interorbital region. Incisors and molars large and broad: m^3 with 9 laminæ, the last very small.

Dimensions of the type:—

Head and body 182 mm.; tail 97; hind foot 30; ear 26.

Skull: greatest length 39; basilar length 32.2; zygomatic breadth 19.8; width of brain-case 16.7; greatest width across nasals 7.2; depth from highest point of orbit to alveolar border at front of m^3 11.8; palatilar length 19.1; length of upper molar series from front alveolar border to back of m^3 11.3.

Hab. Charada, Kaffa. Altitude 6000 feet.

Type. Adult female. B.M. no. 6. 11. 1. 29.

This form was described by Thomas as a race of *typus*; on account of its cranial characters and the occurrence of 9 laminæ in m^3 it is here considered as a distinct species.

X.—Two new Species of *Leuconoe*.

By OLDFIELD THOMAS.

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Leuconoe moluccarum, sp. n.

Like *L. horsfieldi*, but the feet larger and the colour browner.

General characters as in the allied species. Fur soft, fine,

and velvety; hairs on shoulders almost 6 mm. in length, those on lower back 3.5 mm. Colour above sepia-brown, that of *horsfieldi* being blackish; under surface paler brown; the inguinal region brownish white, instead of more or less clear white. Ears and tragus apparently quite as in *horsfieldi*. Feet decidedly larger, and in correlation with this the wing-membrane does not extend so far, being inserted about opposite the base of the calcar.

Skull and teeth quite like those of *horsfieldi*, p^3 similarly crushed in between the approximated p^1 and p^4 above, and p^2 in the tooth-row below, about one-third the area of p^1 .

Dimensions of the type:—

Forearm 40 mm.

Skull: greatest length 15.4; breadth of brain-case 7.5; front of canine to back of m^3 5.9; front of p^4 to back of m^2 3.5.

Dimensions of a spirit-specimen from Port Essington:—

Forearm 41 mm.

Head and body 55; tail 39; ear (inner edge) 13; tragus 5.3; tibia 17.5; hind foot (c. u.) 13.

Hab. East Indian Archipelago from Celebes to the Solomons and North Australia. Type from Ara, Kei Islands.

Type. Adult male. B.M. no. 10. 3. 1. 29. Original number 854. Collected July 1909 by W. Stalker.

This species, although some of the specimens of it had been referred by Dobson to the much larger *L. adversus*, is really very closely allied to the *L. horsfieldi* of Java, Sumatra, and Borneo, but may be distinguished by its larger feet and browner colour. The West Australian *L. macropus* is, as shown by its type, very decidedly larger than *L. moluccarum*, and is indeed so strikingly like the Javan *L. adversus* that, with the imperfect material available, I can perceive no satisfactory reason for its distinction, a conclusion to which Dobson came in 1878.

Leuconoe lepidus, sp. n.

A dark-coloured species with narrow brain-case.

General characters as in *L. horsfieldi*. Colour blackish, the membranes dark brown. Ears about as in *horsfieldi*, laid forward their tips barely reach to the end of the nose. Wings to the side of the metatarsus. Calcar reaching about two-thirds of the distance to the tip of the tail.

Skull in general like that of *horsfieldi*, but the brain-case less inflated, low and narrow, the difference especially marked in contrast with other Bornean examples of the group, which

have rather more swollen brain-cases than in Javan specimens. Small upper premolars not much crushed, p^3 two-thirds the size of p^1 , half internal; below, p_3 is quite in the tooth-row, about half the size of p^1 .

Dimensions of the type (measured on the spirit-specimen) :—

Forearm 37.5 mm.

Head and body 46; tail 35; ear (anterior margin) 13; tragus on inner edge 5; tibia 15; foot 9.5; calcar 12.

Skull: greatest length 15.5; zygomatic breadth 9.2; breadth of brain-case 7.2; front of canine to back of m^3 6; front of p^4 to back of m^2 3.4.

Hab. Baram, Sarawak.

Type. Adult female. B.M. no. 0.7.29.14. Collected and presented by Dr. Charles Hose.

This Baram bat differs from the Javan *L. horsfieldi* by its much smaller and narrower brain-case, and still more so from the other Sarawak and N. Bornean examples of the group, which have the brain-case more swollen than in true *horsfieldi*. These other Bornean specimens I refer provisionally to Miller's *L. carinatae*, though I think it very doubtful if they should be kept distinct from *L. horsfieldi*. But the skull of *L. lepidus* is conspicuously different from any of them.

XI.—Notes on and Descriptions of *Delias*.

By the Hon. WALTER ROTHSCHILD, F.R.S., Ph.D.

1. *Delias singhapura acuta*, subsp. n.

♂. Fore wing more pointed than in *s. singhapura*, and narrowing sharply to apex. Above differs from both *singhapura* and *s. indistincta* in having the black on outer $\frac{1}{3}$ of fore wing absent below vein 2, and reduced to a narrow submarginal cloud between veins 2 and 3. Below the yellow of hind wing is darker and the submarginal patches smaller.

♀. Fore wing long and pointed as in the ♂, NOT rounded. Above more strongly clouded with black. Below the yellow area is reduced and the submarginal spots much smaller.

Hab. ♂, Karo, Aug. 1891 (*Hagen Coll.*); ♀, Selesseh, S.E. Sumatra, 25th July, 1894 (*Dr. Martin*) (♀ type).

2. *Delias rosenbergi salayerana*, subsp. n.

♂. Above resembles *r. rosenbergi* in the sharply cut-off

dark apex of fore wing and white colour. Below it has the much deeper orange of *r. lorquini*, but this orange colour is duller and washed over with cinnamon.

Hab. Salayer Island (*H. Kühn*).

3. *Delias timorensis ardesiaca*, subsp. n.

♂. Above differs from *t. timorensis* in the much greater extent of the white portion of both wings. Below the fore wing is dark brown, NOT black; the pale basal area is much larger, white, NOT yellow, with only a yellow streak in cell below costa. Hind wing, basal area paler yellow, with a white margin, a crimson dot in a white ring at apex of cell; dark area between basal area and crimson submarginal band brownish slate-colour; submarginal band of coalescent spots much wider and duller, more cinnabar-crimson.

♀. Above black-brown, NOT black; basal pale area of both wings less grey and suffused with buff. Below: fore wing, the pale basal area is less yellow, more white, and more extended, the dark outer area black-brown. Hind wing has the wider submarginal crimson band, white outline to yellow basal area, and the slaty colour of discal area, but the discocellular spot is yellow.

Hab. ♂ ? (*H. Kühn*) (but certainly Dammer); ♀, Dammer Island (received from Staudinger) (♀ type).

4. *Delias timorensis romaensis*, subsp. n.

♂. Very small; differs from *t. timorensis* above in having the elongate subapical patches reduced to small white spots widely separated. Below the dark colour is browner, the subapical spots smaller, and the submarginal red line above vein 2 wider.

♀. Above differs in the strongly reduced subapical spots and in the rest of fore wing being almost entirely black, the basal $\frac{1}{4}$ being only powdered with grey slightly. Hind wing has pale basal area narrower. Below the subapical spots are smaller and the submarginal red band wider; a red dot at end of cell.

Hab. Roma Island, Aug. 1902 (*H. Kühn*).

5. *Delias timorensis moaensis*, subsp. n.

♂. Above differs from *t. timorensis* in the much greater extension of the pale area of both wings, on fore wing going far beyond cell and in hind wing reducing outer black border

by $\frac{1}{3}$. Below on fore wing the pale basal area is much extended and more white, reaching tornus below vein 1.

♀. Above the pale area is much more extended and the subapical patches are larger. Below the pale area is larger and the yellow bordered with white, while the red submarginal band is paler and duller.

Hab. Moa Island, Dec. 1902 (*H. Kühn*).

6. *Delias mysis goodenovii*, subsp. n.

♂. Above has black margins to hind wing somewhat wider than in *m. onca*. Below it differs from *m. onca* in the fore wing in having the black of apex and costal area more extended and deeper; in hind wing the yellow is much darker, more orange, and extends nearly all over pale area of wing; the black band on inner side of submarginal red band is wider.

♀. Below differs from ♀ *m. onca* in the entire basal $\frac{2}{3}$ of hind wing being orange-yellow, only veins 4-7 showing white.

Hab. Goodenough Island, 2500-4000 feet, May 1913 (*A. S. Meek*).

7. *Delias mysis rosselliana*, subsp. n.

♂. Differs from *m. goodenovii* above in the marginal band of hind wing being double as wide. Below it differs in the yellow on hind wing being less extensive though quite as dark in colour; the black band inside the red is very much wider.

♀. Above has the margins browner, less black, and the subapical spots yellow, NOT white. Below the yellow on hind wing is less extended and the black inside the red much wider.

Hab. Rossell Island, Jan. 1898 (*A. S. Meek*).

8. *Delias mysis maga*, Grose-Smith.

Delias maga, Grose-Smith, Ann. & Mag. Nat. Hist. (6) xix. p. 405 (1897) (Sud-Est Island).

The ♀ is undescribed.

♀. Above differs from the ♀ of *m. goodenovii* in the almost absent subapical spots on fore wing and in the black outer areas of both wings occupying fully the outer $\frac{1}{3}$ of the wings. Below the orange area of hind wing occupies $\frac{1}{2}$ of the wing and the dark area the outer half; the red band is more uniform in width and nearer the margin.

9. *Delias mysis maforensis*, subsp. n.

♂. Below differs from *m. lara* in the greater extent and darker shade of the yellow basal part of hind wings, it filling $\frac{2}{3}$ INSTEAD of $\frac{1}{3}$ of cell; the red band is wider and the black narrower.

♀. Differs from ♀ *m. lara* below in the much wider extent and darker shade of yellow on hind wing, the much wider black distal area (occupying $\frac{2}{3}$ of wing), and more even width of red band.

Hab. Suer, Mafor Island, May-June 1897 (*W. Doherty*).

10. *Delias caliban satisbona*, subsp. n.

♂. Differs from *c. caliban* below in the reduction in fore wing of the white basal area below vein 3 and in the strong reduction of the basal yellow area in hind wing.

♀. (The female of *c. caliban* is unknown.) Above, head and thorax grey suffused with yellow; abdomen sulphur-yellow. Fore wing, basal $\frac{1}{3}$ obliquely white suffused with sulphur-yellow; outer $\frac{2}{3}$ black; two small white subapical spots. Hind wing, basal half sulphur-yellow, outer half black. Below, fore wing as above, but with four large golden-yellow subapical spots; hind wing black, base and abdominal area powdered with sulphur-yellow; a submarginal band of golden-yellow spots.

Hab. Goodenough Island, 2500-4000 feet, May 1913 (*A. S. Meek*).

11. *Delias waterstradti*, sp. n.

♂. Above canary-yellow tinged with green; apex and costal area of fore wing and margin of hind wing brown. Below, fore wing black-brown, cell densely and rest of basal $\frac{1}{2}$ of wing sparsely powdered with golden yellow; beyond cell and along nervures the yellow powdering is more densely present, almost appearing like a band of yellow patches; a subapical band of large golden-yellow patches. Hind wing, basal $\frac{3}{5}$ golden yellow, powdered in basal $\frac{1}{2}$ with sooty black; outer $\frac{2}{5}$ black-brown, with submarginal row of large golden-yellow patches.

Length of fore wing 34 mm.

Hab. Halmaheira (*Waterstradt*).

12. *Delias totila*, Heller.

Delias totila, Heller, Entom. Nachr. xxii. no. 12, p. 177 (1896) (New Britain).

I have a single ♀ in which the basal half of fore

wing is lavender-blue and the basal half of hind wing is greenish yellow. In the Adams collection in the British Museum the three ♂♂ have the basal half of both wings cadmium-yellow, while the ♀ has the basal half of hind wing, like the fore wing, lavender-blue only tinged with yellow.

13. *Delias funerea funerea*, Rothsch.

Delias funerea, Rothschild, Nov. Zool. vol. i. p. 662, no. 3 (1894) (Halmadeira).

The ♀ of this form not being recorded, I take the opportunity of describing it from the unique specimen in the Adams collection in the British Museum.

♀. Above, fore wing sooty black-brown, powdered with greyish white in basal $\frac{1}{5}$ of wing, on basal $\frac{1}{3}$ of costal area, and densely so along whole of wing below vein 1; a subterminal row of eight greyish-white patches. Hind wing sooty black-brown; fringe and abdominal folds whitish grey, basal half of wing powdered thinly with whitish grey. Below, fore wing as above, but basal $\frac{1}{2}$ strongly powdered with pale grey; cell and second to fifth subterminal patches suffused with lemon-yellow. Hind wing black-brown; a large subcostal patch and a subterminal band of coalescent sagittate patches scarlet; abdominal folds and wings beyond scarlet band strongly suffused with grey; base sulphur-yellow.

14. *Delias ennia mysolensis*, subsp. n.

♂. Below differs from *en. ennia* in the dark margin between tornus and vein 6 being wider and the three yellow patches larger.

♀. Above purer white, the buff suffusion almost absent; grey base of fore wing less extended. Below the black on hind wing is only half as wide as in *en. ennia* and yellow submarginal band is wider.

Hab. Mysol Island, Jan. 1899 (*H. Kühn*) (♀ type).

15. *Delias ennia oetakwensis*, subsp. n.

♂. Above, dark margin on hind wing much narrower than in *en. mysolensis* and *en. ennia*. Below, dark margin of hind wing also much narrower and yellow patches almost absent.

♀. Above grey, base of fore wing much extended, occupying $\frac{1}{4}$ of wing; ground-colour still purer white than in ♀ *en. mysolensis*. Below, dark band of hind wing narrower

than in *en. mysolensis*; basal area of hind wing and submarginal row of patches lemon-yellow, NOT orange; the patches much smaller than in *en. ennia* and *en. mysolensis*.

Hab. S.W. New Guinea (type ♂ near Oetakwa River, Snow Mts., Dutch New Guinea, up to 3500 feet, Oct.–Dec. 1910, *A. S. Meek*).

16. *Delias ennia limbata*, subsp. n.

♂. Above dark, apex of fore wing more extended and blacker than in *en. nigidius*; dark margin to hind wing purer black and reaching to vein 7; the two white submarginal spots found in *nigidius* are entirely absent. Below yellow, area of hind wing much extended; dark margin of hind wing half the width and extending to vein 7; the submarginal orange patches are much smaller.

♀. Above, the outer dark area of both wings darker and blacker; there are TWO instead of FIVE subapical spots in fore wing, and the submarginal white dots in hind wing are absent. Below the basal yellow area of both wings is more extended, the black distal area of hind wing narrower and blacker, and the submarginal row of spots is narrower and deeper orange.

Hab. Sud-Est Island, April 1898 (*A. S. Meek*) (type ♂).

17. *Delias ennia saturata*, subsp. n.

♂. Above the marginal band on hind wing narrower than in *en. nigidius* and *en. limbata*. Below almost the whole of the hind wing saturated with bright yellow; dark marginal border wider than in *en. limbata*, but less wide than in *en. nigidius*; submarginal band of spots much wider and brighter orange.

♀. Above dark, distal part of both wings much narrower than in *en. limbata* and *en. nigidius*, and brown. Below, basal half of hind wing entirely bright yellow, outer half black-brown; the submarginal band of spots between veins 4 and 7 much reduced.

Hab. Goodenough Island, Dec. 1896 (*A. S. Meek*).

18. *Delias ennia xelianthe*, Grose-Smith.

Delias xelianthe, Grose-Smith, Nov. Zool. vol. vii. p. 86 (1900) (British New Guinea).

I have a ♂ of this form from the Sattelberg, German New Guinea.

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19. *Delias enniana obsoleta*, subsp. n.

♂. Below differs from *en. enniana* in the subapical band of spots on fore wing being much reduced and the submarginal row of spots on hind wing being obsolescent; the marginal dark band of hind wing is also much wider.

Hab. Mysol Island, Jan. 1899 (*H. Kühn*).

20. *Delias enniana reducta*, subsp. n.

♂. Above differs from *en. enniana* in the apical dark portion of fore wing being wider, running round tornus on to inner margin, and having only a single subapical spot. Below the black-brown band from costa across discocellulars on fore wing is much reduced, generally forming a narrow curved line only from subcostal along discocellulars, not reaching lower angle of cell; on hind wing the marginal band is narrower and its inner edge is regularly rounded instead of sinuate; the submarginal band of spots is still more reduced, the upper spot only being present and the second to fourth barely indicated by whitish hair-like streaks.

♀. Below, all dark portions reduced and much narrower, and submarginal spots on hind wing much smaller.

Hab. S. and S.E. New Guinea (type ♂, Eilanden River, S.E. Dutch New Guinea, Dec. 1910, *A. S. Meek*).

21. *Delias enniana kapaura*, subsp. n.

♀. Below, differs from *en. reducta* in the much rounder wings and the much greater width of the dark distal portions of both wings; on the hind wing the dark area occupies the distal $\frac{2}{5}$ of wing.

Hab. Kapaur, S.W. New Guinea, Jan.–Feb. 1897 (*W. Doherty*).

22. *Delias dice dice* (Voll.).

Pieris dice, Vollenhoven, Monogr. Pier. p. 39, no. 5, t. iv. fig. 7 (1865) (N.W. New Guinea).

Fruhstorfer, in 'Seitz,' states that the ♂ of this form is unknown. I have a ♂ from the Felder collection received in exchange from the Leyden Museum. I append the description:—

♂. Above hardly distinguishable from *D. enniana*. Below, fore wing much as in *enniana*; hind wing, basal $\frac{5}{6}$ pale, outer $\frac{1}{6}$ brown, enclosing a row of large fulvous-orange spots; of the pale area the basal half is fulvous orange, outer half white.

I also have a number of ♀ ♀ (which are evidently forms of *dice*) from the east side of Geelvink Bay, Humboldt Bay,

Milne Bay, Holnicote Bay, and Rossell Island ; but the ♂ ♂ accompanying them are more or less indistinguishable from my *enniana reducta*, though the respective ♀ ♀ are vastly different. It is quite conceivable that in the future, when more is known of these *Delias*, that *enniana* and *dice* will turn out to be forms of one species.

23. *Delias omissa*, sp. n.

♂. At first sight this much resembles a small *zarate*, Gr.-Sm., but is smaller. Above differs from *zarate* by the much blacker costal area of fore wing and the absolutely straight inner edge of the apical black area, which never has a trace of subapical spots ; the black margin of hind wing is much wider. Below, there are two small yellow dots in apex of fore wing ; the hind wing is uniform canary-yellow, NOT yellow and orange as in *zarate* ; the dark margins of both wings are much straighter on inner edges than in *zarate*.

♀. Differs above in wider dark margin to hind wing and the straighter inner edge of margins of both wings. Below it differs in both wings by the straighter inner edges of the dark margins and in the total absence of the yellow sub-marginal spots of hind wings.

Length of fore wing, ♂ 24, ♀ 26 mm. ; expanse, ♂ 53, ♀ 57 mm.

Hab. Eastern New Guinea (type ♀, Upper Aroa River, British New Guinea, Feb. 1903, A. S. Meek).

24. *Delias madetes neohannoverana*, subsp. n.

♂. Differs from *m. madetes* above in the much narrower black edging to the hind wing, which is bordered with lemon-yellow, not found in *m. madetes*. Below the orange is more yellow and paler.

♀. Differs in the spots above and the pale area of hind wing being much whiter.

Hab. New Hanover, Feb.-March 1897 (F. Cayley Webster).

25. *Delias eudiabolus*, sp. n.

♂. Resembles a minute *ladas*. Above, fore wing more pointed than in *ladas*, and termen much straighter ; the black edge of hind wing is narrower. Below, the apical dark area of fore wing is much wider and basicostal yellow streak on hind wing is clearer yellow.

♀. Above, all dark margins are much narrower and apical area is edged inwardly with yellow, NOT found in *ladas*. Below the abdomen is white, while in *ladas* it is yellow ; the

apical dark area of fore wing is wider and the basicostal yellow streak on hind wing is clear yellow.

Length of fore wing: *eudiabolus*, ♂ 21.5, ♀ 23 mm.—expanse, ♂ 47, ♀ 50 mm.; *ladas*, ♂ 34, ♀ 29 mm.—expanse, ♂ 74, ♀ 64 mm.

Hab. British New Guinea (type ♀, Upper Aroa River, Brit. New Guinea, March 1903, A. S. Meek).

26. *Delias aglaia angustifascia*, subsp. n.

Ernhstorfer quotes *agl. pandecta*, Stdgr., from N. Borneo, with a ?. I have two ♂ ♂ and one ♀ from there, and they are very distinct, the ♀ being nearer *agl. goda* ♀.

♂. Differs from *agl. goda* in the whitish, not blue-grey markings and the reduction of the yellow on hind wings.

♀. Differs from *agl. goda* in the narrower oblique white band on fore wing, this being even narrower than in *agl. beata*.

Hab. N. Borneo (type ♂, Mt. Mulu, 1000–4000 feet, Hose).

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 24th, 1914.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The following communication was read:—

‘The Trilobite Fauna of the Middle Cambrian of the St. Tudwal’s Peninsula (Carnarvonshire).’ By Tressilian Charles Nicholas, B.A., F.G.S.

In a previous paper on the geology of the St. Tudwal’s Peninsula approximate determinations were given of the fossils found in the Upper Caered Mudstones and Nant-pig Mudstones, both of Middle Cambrian age. The object of the present paper is to give detailed descriptions of several forms which are either new or of particular interest: namely, *Agnostus kjerulfi*, two new species of *Agnostus*, a species of *Agraulos*, of *Dorypyge*, of *Corynexochus*, and *Solenopleura applanata*, and to give brief notes on a number of other species, including *Agnostus punctuosus*, *A. exaratus*, *A. fissus*, *A. altus*, *A. truncatus*, *Microdiscus punctatus*, *Conocoryphe* cf. *dalmani*, and *Paradoxides hicksii*.

The vertical distribution of the different forms through the Upper Caered and Nant-pig Mudstones is tabulated and compared with that of other areas, particularly the succession recently established by Mr. V. C. Illing in the Abbey Shales of Nuneaton. This comparison strengthens the opinion already put forward in the previous communication, that there is a non-sequence at the base of the *Lingula* Flags in the St. Tudwal’s Peninsula.

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The description on p. 56 refers to *Macrochæta clavicornis* after line 1; and in the description of Plate III., fig. 5 refers to *Prægeria*, the rest of the figs. (6-9) refer to *Macrochæta clavicornis*.

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THE ANNALS

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MAGAZINE OF NATURAL HISTORY.

[EIGHTH SERIES.]

No. 86. FEBRUARY 1915.

XII.—*The Early Stages of Paltostoma schineri, Williston* [Diptera, Blepharoceridæ]. By HUGH SCOTT, M.A. (Cantab.), F.L.S., F.E.S., Curator in Entomology in the University of Cambridge. *With a Description of the Female of the same Species*, by C. G. LAMB, M.A., B.Sc., Clare College, Cambridge.

[Plates IX.-XI.]

I. INTRODUCTION.

The remarkable family of the "net-winged midges," or Blepharoceridæ, is so far known to be represented in the Neotropical region by five species belonging to three genera, which compose Bezzi's group Paltostominæ (*op. cit.* 1913). These have been described respectively from Mexico, the Antilles (St. Vincent), Colombia, and Brazil. But, so far as I am aware, no species has ever been recorded from Trinidad or from that part of the South American continent immediately adjacent. During a brief visit to Trinidad in 1912, I endeavoured specially to obtain material of some representative of the Blepharoceridæ from that island. I should not have succeeded in this quest in the short time at my disposal, had it not been for the kind help of my friend, Mr. F. W. Urich, Government Entomologist of the Colony. He had observed Blepharocerid larvæ in certain places previous to my visit, and was able to conduct me directly to a spot where we collected about forty larvæ and five pupæ, which were preserved in 70 per cent. alcohol. Our search for the

imagines was, however, in vain. For this reason the larvæ and pupæ were never critically examined till 1914, when I received from Mr. Urich two ♀ imagines which he had collected in another locality, some miles from the one which I visited in his company. These two imagines were studied by Mr. C. G. Lamb, who found them to belong to the genus *Paltostoma*, and who suggested to me that I should investigate the larvæ and pupæ, with a view to discovering whether or not they belong to the same species or genus as the imagines.

I have succeeded in dissecting a ♂ fly, well advanced in development, out of one of the pupæ collected in 1912, and find that it also belongs to the genus *Paltostoma*. On comparing it with one of the four ♂ ♂ * found in St. Vincent, which Williston (*op. cit.*) described as *Paltostoma schineri*, I have no hesitation in referring it to that species, the genitalia and other structural characters agreeing exactly. The identity of the pupæ is thus settled, and it is also beyond any reasonable doubt that the two ♀ imagines obtained by Urich are the ♀ sex of the same species, since they closely agree with Williston's co-types in all points excepting those subject to sexual difference. They are therefore described by Lamb in Section VI. of this paper (p. 195) as the ♀ of *Paltostoma schineri*, hitherto known only in the ♂ sex.

Moreover, the early stages of *Paltostoma schineri* are hitherto undescribed, and, so far as the writer can discover, no description has been published of the larva or pupa of any of its congeners †. As stated above, there is positive proof that the pupæ collected in 1912 belong to *P. schineri*, and there is the strongest presumption for supposing that the larvæ also belong to that species, since they are all of one kind, and they and the pupæ were all taken within an area of a few square feet. I have examined every larva singly, hoping to find in one or more specimens some trace of the pupal integument forming under the last larval skin, and thus to gain visual proof of their belonging to the same species as the pupæ. This has been denied me; nevertheless,

* This specimen was kindly lent from the British Museum by Mr. F. W. Edwards.

† Unless, possibly, part of the larval material described by F. Müller (*op. cit.*) belonged to the genus *Paltostoma*. Müller is known to have had more than one species before him, witness his Pl. 4. figs. 2 & 3, which show two very different kinds of larvæ. The imagines of one of his species were referred by Brauer to the genus *Paltostoma*, but it was subsequently shown that none of Müller's imaginal forms belonged to that genus (see Osten-Sacken, *op. cit.* p. 167), though it is not impossible that some of his larvæ may have belonged to it.

I have no hesitation, for the other reasons given above, in referring the larvæ to *P. schineri*.

The main purposes of this paper are : (a) description of the ♀ imago of *P. schineri*; (b) description of the larva and pupa; (c) description of the mouth-parts, and some other structural points, of the ♂ imago; (d) some discussion of the affinities of *Paltostoma* as indicated by *P. schineri* in all its stages, and comparison with the allied South African *Kelloggina barnardi*, Edwards. I am indebted to Messrs. W. R. Thompson and F. Balfour-Browne, of the Cambridge Zoological Laboratory, for assistance and suggestions.

One of the ♀ imagines, with specimens of larvæ and pupæ, has been presented to the British Museum. The other ♀ imago and the bulk of the larval and pupal material are in the Cambridge University Museum.

II. COLLECTION OF THE MATERIAL.

The locality in which the ♀ imagines were captured is fifteen miles or more from that in which the larvæ and pupæ were found two years before, but both places are on the course of streams flowing down the southern slopes of the range which runs right across the north of the island.

The two ♀ imagines were obtained in January 1914 on the Arima River, at an elevation of about 600 feet; the time was about 10 A.M., and the sun was shining, but the flies themselves were in a shady place. They were hovering over a spot where a thin film of water rushed over large stones, and they appeared to Ulrich to be searching for a suitable place in which to oviposit. He adds that in flight they looked like small Tipulids. He states that he has many times swept foliage on the banks of streams in the Northern Range, but has never succeeded in capturing any Blepharoceridæ in that way; he has not observed any on flowers or attacking other insects (*cf.* p. 193 of this paper), nor has he been attacked by them while bathing or at any other time.

It is noteworthy that the larvæ and pupæ were taken at an elevation of only about 50 feet above sea-level. Ulrich has found Blepharocerid larvæ at various places, mostly in the streams of the Northern Range, from almost sea-level up to 2000 feet, above which no observations have been made. The material dealt with here was collected on March 22nd, 1912, in a waterfall in the Diego Martin district. The fall ran down very steep smooth faces of rock, interrupted by narrow ledges. Only a very thin sheet of water swept over the cliff, for the dry season was at its height, and in addition

an exceptional drought had prevailed for some time. By climbing on to the ledges, access was obtained to the smooth cliff-faces, which were covered in places with great numbers of the larvæ, these appearing dark against the grey background of rock. As has been found by previous observers, the larvæ, when disturbed, shift their position slightly without becoming detached from the rock. Considerable difficulty was experienced in collecting them, because, when detached, they were so easily and rapidly swept away by the swift-falling water. I did not then know of the method of collecting such larvæ employed by Dr. Lutz in Brazil. He states (*op. cit.* p. 82) that if they are covered with the hand and rolled slightly to and fro, they loosen themselves from the rock and fix themselves firmly by their suckers to the collector's hand; thus a number may be collected in a short time. Still greater difficulty was experienced with the pupæ: these are cemented to the rock by their adhesive pads, and when force was used they broke loose suddenly and were not easily caught before being swept away. In such a situation as this, it is not hard to imagine how rapid the unfolding of the wings must needs be on the emergence of the imagines, if any of the latter are to avoid being caught by the rushing water—a rapidity of unfolding provided for, as is well known, by the wings being already developed to their full size in the pupa, a condition which necessitates a complex system of folding, which in its turn produces the “secondary veining” so characteristic of the family.

Besides the Blepharocerid larvæ there were on the steep rock-faces some Simuliid larvæ, also curving tubes composed of web and grains of sand, inhabited by larvæ of a Psychomyid caddis-fly. Small caddis-flies were flitting in shady places over the surface of the falling water, and occasionally settling on dry rock close thereto. Some of these were captured, and have been described by G. Uhner* as *Melanotrichia insularis*, a new species of Psychomyid; they are considered by him to be the imagines of the tube-inhabiting larvæ.

The vegetation bordering the stream below the fall was swept in the hope of obtaining imagines of the Blepharocerid. As has been said, this hope was not then fulfilled, but specimens were obtained of a fly of such remarkable appearance that at first sight it was thought to be the special object of search. It proved, however, to be a Mycetophilid of the curious genus *Lygistorrhina* (= *Probolæus*), and has

* Deutsche ent. Zeitschr. 1913, p. 386.

been described by F. W. Edwards * as *Lygistorrhina urichi*. The writer is tempted to prolong this digression, and to linger in memory over the beauty of the spot where these captures were made. One recalls the forest-clad ravine, not penetrated by the direct sunlight up to the time of our departure at 10:30 A.M.; the cliff, with the water coursing down it, and great tussocks of hanging grass growing in its crevices; a humming-bird visiting the scarlet clusters of flowers on a tree (*Brownea*) by the side of the fall; a great blue *Morpho* settling on the rock close to the water, and two *Heliconius*, with vivid orange-red patches on the fore wings, circling over the frothing pool at the foot of the cascade.

III. THE LARVA. (Pl. IX. figs. 1-4.)

Diagnosis.—Length 4-6 mm. Antennæ short, two-jointed. Dorsal surface furnished with stout spines. Branchial filaments arranged in tufts, 10 filaments in each tuft in the full-grown larva. Lateral processes well developed, simple, pediform, ciliate, without long setæ projecting beyond the ciliæ. Sixth segment with only one pair of lateral processes, and with its hind margin bearing six long setæ arising from four places.

The following is a more detailed description of the larva, in the making of which I have been guided largely by Fritz Müller's well-known and fine work (cited in list).

Length, varying among thirty-nine larvæ, from 4.5-6 mm. One larva, only partly grown, measures only 3.25 mm.

Colour above dark brownish; the posterior margin of the cephalothoracic and of the four intermediate segments pale, whitish; the rounded posterior margin of the terminal (sixth) segment darker, blackish; the anterior part of the cephalothorax, comprising the five "cephalic areas" of F. Müller, is also somewhat infusate, darker than the posterior part; antennæ blackish; lateral processes yellowish brown, ciliæ pale. Ventrally the colour is very much lighter, the median part of each segment, surrounding the sucker, being whitish.

Spines, Scales, &c.—The disposition of the larger *spines* on the dorsal surface is described in detail below. But, besides these, a very high power shows that the whole dorsal surface bears, scattered at rather wide intervals, very minute, colourless, erect, shortly lanceolate *scales*, of the same nature as those figured by F. Müller on pl. 4, figs. 15, 16 of his work,

* Ann. & Mag. Nat. Hist. ser. 8, vol. x. 1912, p. 203. The congeneric *L. singularis* (Williston), which was the type of the genus *Probolæus*, was found in St. Vincent.

though not identical with them in shape. Also, the whole dorsal surface is seen under a high power to be densely covered with microscopic *rugæ*, excepting the five "cephalic areas" on the anterior part of the cephalothorax, which are smooth, contrasting remarkably with the rest of the surface—a contrast which Müller also noticed in his larvæ (*op. cit.* p. 50).

Antennæ (figs. 3, 4) very short, two-jointed; basal joint broadening from base to apex; second joint slightly longer, narrower, of about the same thickness at base and apex, but slightly thicker in the middle. The apex of the second joint is obliquely truncate, and bears a remarkable sense-organ (fig. 4); right to one side is a long slightly curved seta, with an erect scale standing at its base; towards the other side is a group consisting of a transparent, colourless vesicle (the sharp apex of which appears more strongly chitinized and is pigmented), while round its base is a group of three brown scales, the middle one bluntly lanceolate, the two others slightly longer and with broad dentate apices.

Being only able to devote a limited time to this work, I have perforce omitted an examination of the larval *moult-parts*. F. Müller dealt with these organs in detail in his material.

Cephalothorax.—I follow F. Müller (*op. cit.* p. 50) in the naming of the cephalic areas, and have attempted to indicate their outline by means of dotted lines in Pl. IX. fig. 1. The *median area* (fig. 1, *m.a.*) is narrow, lanceolate, slightly broader in front, bluntly pointed at either extremity. The *intermediate areas* (fig. 1, *i.a.*) form 4-sided figures, narrower in front, with hind margins slightly curved. The *lateral areas* (fig. 1, *l.a.*) stretch much further back along the sides of the cephalothorax, their hind margins running obliquely backwards and outwards; each lateral area is separated from the adjoining intermediate area by a narrow strip of the ordinary rugose chitin, which runs forward from the posterior part of the segment to the base of the antenna (*cf.* Müller's pl. iv. fig. 10). The sutures along the inner and posterior margins of the lateral areas are pale. Each lateral area has on its inner side in front a pale elongate-ovoid mark, under the anterior extremity of which is an ovoid black mass. The pale mark is the transparent *cornea*, the black mass is a mass of nervous substance which may probably be regarded as an *eye* * (Pl. IX. fig. 1, *e.*); the

* In some of the specimens (preserved in alcohol) the black mass is withdrawn from immediately beneath the cornea deeper into the interior of the cephalothorax.

whole arrangement greatly resembles that figured by Müller (*op. cit.* pl. vi. fig. 7, and p. 73).

The part of the dorsal surface behind the cephalic areas is divided into two portions by a *transverse line* of dark spots, which are seen under a high power to consist of small smooth areas set like islands among the dense rugæ of the general surface. The anterior of these portions bears a pair of very conspicuous *eye-like spots* (fig. 1, *e.s.*), situated one on either side, some distance behind the division between the lateral and intermediate areas. Each spot consists of a dark body, the chitin immediately surrounding which is pale and almost colourless. F. Müller (*op. cit.* p. 51, pl. iv. fig. 10) describes and figures organs of like nature in his larva, and comments on their resemblance to eyes. They must not be confounded with the true visual organs described above. The writer is inclined to believe that these dark spots are the (as yet functionless) first pair of spiracles; Müller describes these (*op. cit.* pp. 67, 70) as situated on the dorsal side of the cephalothorax, but he does not appear to state whether they are identical with the eye-like spots or not. Immediately behind the eye-like spots, and in front of the transverse line, are two deep *pits* (Pl. IX. fig. 1, *p.*) projecting downwards into the interior of the body. The posterior part of the cephalothorax (behind the transverse line) bears two conical *spines*, similar to those on the succeeding segments; and the hind margin bears a series of spines on either side behind the lateral process. *Ventrally*, the cephalothoracic segment is ciliate towards the sides.

Segments 2-5.—There is a series of conical spines, short and sharp, along the front margins of the projecting lateral portions of each segment; and a less regular series along the hind margins of these lateral portions. These anterior and posterior marginal series are continued across the dorsum of the segment as two transverse series, each consisting of about 4-6 spines, widely spaced out, and when viewed from directly above appearing as dark spots. There are also scattered smaller spines on the projecting lateral parts of the segment. *Ventrally*, the surface is smooth, except for a rugulose-spinulose area on either side at the base of the lateral process (Pl. IX. fig. 2).

The *lateral processes* (both of these and of the sixth and cephalothoracic segments) are simple, pediform, bearing long fine ciliæ dorsally except at the base. There are no spines or setæ exceeding the ciliæ in length, as in some genera, but in balsam-mounts each lateral process is seen to bear a series of several spines shorter than the ciliæ and concealed from ordinary view among these. *Ventrally* the

lateral process is bare, and has at its apex a sole-like area, the surface of which appears different to the general surface of the organ; in a balsam-mount under a high power this area has an exceedingly finely spotted appearance, due to the presence of an extremely dense felt-work of very minute, short, curved setæ (possibly not in any way homologous with ordinary setæ or spines, but formed by some kind of breaking up of the general chitinous surface). A sole-like area, apparently closely similar, is present in the lateral processes of the larva of the allied *Kelloggina barnardi*.

Branchial filaments (Pl. IX. fig. 2) arranged in tufts: in the full-grown larva there are ten in each tuft, this being apparently the largest number yet recorded in the family; almost always three are directed forwards, three backwards, and the remaining four ventrally and outwards. There is among the material one much younger larva, only 3.25 mm. long; it agrees closely with the larger larvæ, so that I have very little doubt it belongs to the same species, but the number of branchial filaments in each tuft is much smaller, being at most six, and sometimes apparently only five. It therefore appears that the number of filaments in a tuft increases with the growth of the larva. A branchial tuft of a full-grown larva, stained with para-carminé and mounted in balsam, shows distinctly that the ten filaments arise in five pairs, the bases of the two members of each pair being contiguous. It is therefore possible that the increase in number of the filaments occurs by a process of fission during the development of the larva.

Additional support is given to the above conclusion by two *Liponeura*-larvæ preserved in the Cambridge Museum. They were collected in the Rhone Valley in July 1897 by W. Bateson, F.R.S., and are probably *Liponeura cinerascens*, Loew, as they agree with Bezzi's description (*op. cit.* 1913, p. 77) of that species in all points (except, possibly, that of colour). One of these larvæ is only about half the size of the other; and, while the larger one has in each tuft the number of branchial filaments characteristic of the genus, namely seven, the half-grown larva has only four filaments in each tuft. The number of filaments in a tuft is a very important systematic character; evidently, then, one must beware of being led to false conclusions by the examination only of partly-grown specimens.

Terminal (i. e., Sixth) Segment (Pl. IX. figs. 1, 2).—The anterior portion, bearing the lateral processes, is almost identical in form with segments 2-5; its branchial filaments

are the same in number and arrangement, also its dorsal spines, and the lateral processes are similar. The posterior or anal portion has its margin entire, and four or five spines on either side near the base; the hind angles are obtuse and rounded, and the hind margin forms a broad curve; the margin bears six long fine setæ, on either side two arise contiguously just under the margin immediately in front of the angle, and one on the hind margin rather less than halfway from the angle to the middle line; they are very easily broken off, hence one or more are frequently missing.

The *anal tuft* consists of four very short branchial filaments, sometimes partly hidden by the sucker.

Spiracles (Pl. IX. fig. 2, s.).—The second to ninth pairs are visible as black spots on the ventral surface, in almost the same situations as those described and figured by F. Müller for his larva (*op. cit.* pp. 66-70, pl. vi. figs. 1-2). There are two close together on either side of the cephalothoracic segment, a little within the base of the lateral process. Each of the segments 2-6 bears a pair in front, situated near the angles formed by the lateral margins where these turn outwards to the bases of the lateral processes; these spiracles are often hidden by the outspreading branchial filaments. In addition to these, the sixth segment bears a second and more conspicuous pair on its posterior (anal) division, near the base, on either side of the sucker. I have been unable to trace the first pair (which Müller described as being on the *dorsal* wall of the cephalothorax), unless the "eye-like spots" be they (see above, p. 187). Müller found the spiracles in his larva to be functionless, and connected with the functional tracheal system by slender impervious cords which he termed "truncos iniciaes."

IV. THE PUPA. (Pl. X. fig. 5; Pl. IX. figs. 6-8.)

Diagnosis.—Length ca. 3.5-4 mm. Dorsal surface bearing numerous erect black setæ, the arrangement of which is described in detail below. Respiratory horns with the outer laminae triangular, with pointed apex. [Adhesive pads four in number on either side of the body in all the material before me.]

The pupa is reddish or yellowish brown, rather shortly and broadly ovoid, not very strongly convex. The segmentation is normal (*cf.* Müller, *op. cit.* pp. 75-79, pl. vii. fig. 4), the metathorax and first two abdominal segments not reaching the sides of the body, but being enclosed between the mesothorax and third abdominal segment. The dorsal surface bears very numerous erect black setæ of varying

lengths, on the whole stronger and more numerous at the sides of the body and along the sutures between the segments. They are very easily detached and lost in preserved material, and fig. 5 (Pl. X.) is taken from the only one of my specimens in which they are at all complete: this figure shows their arrangement. They are present, long and strong, along the sutures dividing head from thorax, on the sides of the prothorax, and the sutures dividing pro- from mesothorax; the mesothorax has a group of short fine ones on either side of the middle longitudinal line, but is otherwise bare, even at the sides; the small metathorax and first abdominal segment have short fine setæ on their margins and also very scantily on their surfaces; on the rest of the dorsal surface there is a fairly dense series along each suture, composed of long setæ on the front margin of each segment and short ones on the hind margin of the preceding segment; the setæ of these marginal series are shorter in the median portion and longer at the sides; the surfaces of the segments bear scattered shorter setæ in the median part and scattered longer ones at the sides, there being a more or less bare space between the median and lateral bristles, except on the last two or three segments, where the median bristles are longer and denser and practically continuous with the lateral ones.

Adhesive Pads.—In the material before me the pupa adheres to the rock by means of eight adhesive pads, four on either side of the ventral surface, on the third, fourth, fifth, and sixth abdominal segments. The pupæ examined by Müller had in most cases only three adhesive pads on either side, on the fourth, fifth, and sixth segments (*op. cit.* p. 77, pl. vii. fig. 3), and this is the number given by Kellogg (1903, p. 213).

Respiratory Horns (Pl. IX. figs. 6–8).—Judging from figures of pupæ of various genera, the form of these organs may be of some systematic value. As is well known, each consists of four leaves or *laminæ*, the two outer of which are stronger, the two inner more delicate. Fig. 8 shows the ground-plan of the four laminæ of the left side of the body in the material before me: *m.l.* is the median line of the thorax; it is seen that the anterior outer lamina (*a.o.l.*) is convex on its anterior and concave on its posterior surface; the converse is the case with the posterior outer lamina (*p.o.l.*); of the two inner laminæ the posterior (*p.i.l.*) arises slightly nearer the middle line than the anterior (*a.i.l.*); the spiracle (*s.*) is situated between these, a slit-like orifice almost at right angles to the long axis of the body. The

two *outer laminae* (fig. 6) are triangular, with acute apex; the inner edge (*i. e.* towards the middle line) is convexly curved, the outer edge (towards the side of the body) is sinuate, slightly concave towards the apex; near the inner edge the substance appears more delicate, forming a paler, more translucent area, the limits of which I have indicated by a dotted line (fig. 6, *p.a.*). The two *inner laminae* are somewhat different in form from the outer and from one another; fig. 7 shows their position relative to one another. The entire substance of all four laminae, seen under a high power, somewhat resembles a piece of plant-tissue, consisting of elongate darker areas separated by a network of more translucent lines.

V. THE MALE IMAGO. (Pl. X. figs. 9-14; Pl. XI. fig. 15.)

Williston's systematic description of the ♂ was published in *Trans. Ent. Soc. London*, 1896, pp. 269, 270. On pl. viii. of that work (figs. 27 *a, b*) are figured the wing (not quite correctly, as shown below by Lamb), the head and proboscis in side view, and the hypopygium in side view. It is only intended here to add structural descriptions of certain parts, particularly the mouth-parts. These descriptions are made from the ♂ dissected out of the pupa, various parts of which have been mounted in balsam, and which has, as stated above, been closely compared with one of Williston's co-types.

The specimen is sufficiently developed to contain a considerable quantity of pigment, the most strongly pigmented portions being: (*a*) the eyes, (*b*) a dark spot at the apex of each of the palpi (see below), (*c*) a dark spot at the extreme base of each femur, on the anterior side, at the point of articulation with the trochanter (similar dark spots are present on the femora of the ♂ co-type and of the 2 ♀ ♀).

There is no trace of differentiation of the upper and lower facets of the *eyes*. *Antennae* (Pl. X. fig. 9) 15-jointed; joints 1 and 2 large, joint 2 pyriform with apex subtruncate, joint 3 shorter than those which follow, much narrowed at the base, succeeding joints about equally broad at base and apex, joint 5 slightly longer than joint 4, joints 6-10 subequal in length, joints 11-15 shorter, joint 15 with apex bluntly rounded. Seen under high power, joints 4-15 bear numerous fairly stout, short, sharp-pointed hairs, directed apexwards; joint 3 bears them only on its apical half, and on joints 1 and 2 they are scanty.

Mouth-parts (Pl. X. figs. 9-11) conforming in general to the usual Blepharocerid type (the ♂ has no mandibles);

they are characterized by the great length and slenderness of the proboscis and the great reduction of the palpi.

Labrum (fig. 9, *labr.*) very long and slender, tapering gradually throughout to an exceedingly fine point; under a high power its upper surface is seen to be covered with extremely minute and short hairs; at the sides it is bent strongly downwards, so as to form a groove on its posterior (ventral) surface; in the balsam-mount it is slightly twisted, so that one of these bent-over flanges is seen in face-view near the apex; this flange appears as a hyaline membrane, the edge of which, near the apex of the labrum, is uneven, being raised into several minute tooth-like prominences, which, however, appear hardly definite enough to be regarded as actual teeth.

Hypopharynx (figs. 9, *hyp.*, & 11) also extremely long and slender, being only just surpassed in length by the labrum, narrowing gradually, but *not* ending in a point; on the contrary, the apex is slightly bifid, each minute prominence bearing fine hairs; the two lateral edges of the hypopharynx also bear fine hairs near the apex.

Maxillæ (fig. 9, *mx.*).—The lobes are long and slender, but reach to less than half the length of the labrum and hypopharynx; they are almost hyaline, flattened, and blade-like, with apex not pointed, but bluntly rounded.

Palpi (figs. 9, 10) extremely short, and partly hidden by the base of the proboscis; when detached and examined separately (fig. 10) seen to consist of two parts separated by a constriction, but there is no very definite articulation of two distinct joints, so that it is hard to say whether they should be regarded as truly two- or as one-jointed. The arrangement of minute hairs and long setæ is shown in fig. 10. The basal part is longer and narrower, the apical shorter and broader. The apex is truncate, and hollowed out into a deep blackish-pigmented cup, which forms the dark spot mentioned above as so conspicuous in the pupa. Under a high power the inner walls at the bottom of this apical cup are seen to bear minute chitinous ring-like structures, the exact nature of which I could not determine. I am convinced that the above is the true form of the palpi, and that no other joints have been broken off: for, firstly, both palpi are exactly the same, and I saw no trace of any other joints before or during the dissection of the insect out of the pupa; secondly, the form and pigmentation of the hollow cup is quite definite and clear; thirdly, all ♂♂ of this genus have been described as having the palpi either invisible or extremely short, and in

Williston's dried ♂ co-type they appear as minute one- or two-jointed organs, only there they are uniformly dark, not pale with only the apical pit dark, as is the case in the (perhaps incompletely-pigmented) pupa.

Labium (fig. 9, *lab.*) very long and narrow, equalling the labrum and hypopharynx in length; there is a transverse line of weakness near the base, at which the organ can evidently be bent; another line of weakness quite close to the apex, proximal to the small short labellar portion; owing to the apical part of the organ unfortunately being twisted over on to its side, it is impossible to make out whether, or how far, it is divided into two separate labellæ.

[*Mouth-parts of ♀*.—Some brief remarks on the mouth-parts in this sex are inserted here. Paucity of material has prevented my dissecting these organs in one of the ♀ described below by Lamb, and I have only been able to examine them superficially in the dried insect (Pl. XI. fig. 17). The proboscis is shorter and much more robust than in the ♂, and the palpi are elongate, consisting of at least three (perhaps four) joints. The comparative shortness and stoutness of the proboscis has been mentioned by Bezzi in his description of *P. bellardii* ♀ (*op. cit.* 1913, p. 64).]

I have dissected and mounted the mouth-parts of a ♂ of the South African *Kelloggina barnardi*, Edwards, for comparison with those of the ♂ *Paltostoma*. In *K. barnardi* also the parts are much elongated, but not nearly so long and slender as in the *Paltostoma*. *K. barnardi* has the labrum tapering to a fine sharp point; hypopharynx long and narrow, but much broader in proportion to its length than in the *Paltostoma*, its edges apparently devoid of hairs, its apex not bifid but coming to a point (fig. 12); maxillæ with the lobes rather more pointed at the apex than in *Paltostoma*, and with the palpi much exceeding the lobes in length, and composed of four joints, the basal one very elongate, subequal in length to the lobe, the succeeding ones becoming gradually shorter; labium much shorter and broader in proportion than in *Paltostoma*. [It may be added that, under a high power, no sign of transverse division or differentiation of upper and lower facets could be seen in the eyes of *K. barnardi*.]

There is no direct evidence of the feeding-habits of either sex of *Paltostoma*. One cannot say what is the reason of the extreme length and slenderness of the parts in the ♂. The hypopharynx does not give at all the impression of a piercing organ, but would seem to be suitable for feeding on nectar. There appears to be considerable diversity of

feeding-habit in the family Blepharoceridae. Kellogg (*op. cit.* 1903 and 1907) describes the ♀ ♀ of *Blepharocera tenuipes*, Walker (*capitata*, Loew), as feeding on tiny Chironomid midges, which they captured on the wing, lacerated with their mandibles, and from which they then absorbed the body-juices; but the ♂ ♂, which have no mandibles, were absent from the feeding-ground, and probably have a totally different foot-habit. On the other hand, Hetschko (*op. cit.*) in Corsica observed *both sexes* of *Apistomyia elegans*, Bigot, *feeding together on nectar*, thereby confirming the earlier observations of Schmuse, part of which Kellogg (*op. cit.* 1907, p. 5) doubted. The *Apistomyia* were seen on a number of occasions, at all hours of the day, feeding almost exclusively on the flowers of a Composite (*Helichrysum microphyllum*); though present in numbers, the majority appear to have been ♀ ♀. None were ever observed to capture other insects, and no insects which they could have captured were present on the flowers. *Apistomyia* belongs to a different division of the family to either *Blepharocera* or *Paltostoma*, but like them it shows great dissimilarity between the ♂ and ♀ mouth-parts, only the ♀ possessing mandibles, and there being other differences. Yet Hetschko found both sexes exhibiting the nectar-feeding habit at the same time.

♂ *Genital Armature*.—This is shown in Pl. X. fig. 13, viewed as a transparency from the *ventral* side. The terminal *dorsal segment* of the body is rather deeply and widely sinuate-emarginate in the middle behind, and its hind angles are rounded; at its sides and hind angles it bears long setæ directed outwards; at its sides, too, it is strongly deflexed, and the deflexed portions bear long setæ directed inwards towards the middle line. Ventrally are articulated the two stout *claspers*, each bent inwards somewhat towards the apex, which is blunt, and each bearing on its outer side a short projection ending in a stout spine, somewhat recalling a very small branch of an antler. Between the bases of the claspers projects a small subtriangular plate with rounded apex, just exceeding in length the base of the sinuation of the dorsal plate. These parts all agree closely with those of Williston's co-type.

Legs, Tarsi.—The legs are thickly covered with blackish setæ. The hind tibiæ have the single apical spur characteristic of the genus. The *tarsi* (Pl. X. fig. 14) have a group of stout black spines underneath the basal part of the terminal joint; each of the *claws* has a moderately long stout process on its ventral side near the base. The

tarsi and claws of Williston's ♂ co-type, and of the ♀ ♀ described by Lamb, agree closely with those of the ♂ before me.

VI. THE FEMALE IMAGO. (Pl. XI. figs. 16, 17.)

(By C. G. LAMB.)

♀. *Head*.—*Eyes* with no unfacetted cross-line and with all the facets equal; minutely, densely, and palely pubescent.

Top view (fig. 16). Head much rounded behind, dark orange; this colour extends beyond the ocellar hump, whence it is further continued in a broad line to the base of the antennæ, the stripe narrows towards the front; on each side of it lies a silvery stripe of about the same width, which extends right up to the boundary of the eyes. The ocellar hump is in the shape of a tetrahedron, with much rounded angles; it is deep black with conspicuous silvery ocelli arranged in an equilateral triangle round the base of the hump.

Front view. The face is quite parallel-sided from below the antennæ, orange-yellow with narrow silvery eye-margins; the epistoma is divided from the clypeus by a silver-edged furrow; the clypeus itself is concolorous with the face, and has silvery borders and a fine silvery cross-band; the proboscis is a little more than twice as long as the maximum vertical eye-depth; it is orange-yellow with an acuminate tip; the palpi are black, about as long as the head-depth, with three or four indistinct, pyriform, somewhat hairy joints of almost equal length, which are a little flattened in the dried state. The antennæ are black, except the two basal joints which are very indistinctly rufous; first joint with two or three long hairs outside, second long, cup-shaped, others moniliform.

In *side view* (fig. 17) the black rounded ocellar hump is very prominent, the tongue below the level of the palpi attenuates but little to tip.

Thorax.—*Top view* (fig. 16). The mesothorax overhangs the prothorax in front; it is shining orange, much darker in front, with silvery reflections on darker areas at the sides; there is a minute silvery spot just in the middle over the prothorax; the humeral calli resemble stout orange scales at the front angle; behind the dark front portion the disc is paler orange down to the two oblique sutures that start just above the front of the wing-bases, and slope backwards and nearly meet in the mid-line, where they end in minute dots. Just in front of these sutures the orange is again darkened and silvery in two triangular patches, the hypotenuses of

the triangles lying along the two sutures. From the sutures to the scutellum the disc is suffused brown-orange, and on each side is an elongate silvery spot over the wing-base. The scutellum is cut off by a sulcus, which is deep except at its middle third; in form it is a narrow elongate arch, it is narrowly pale at the base, the rest being about the same colour as the hind part of the thoracic disc. The metanotum is greyish in the centre and furrowed transversely. The prothorax is very evident, arched in plan-profile, the "springing" of the arch being just beyond the humeral calli; the disc is pale, but the margin dark grey; in front of it is a well-marked dark orange neck-collar, silvery on the sides; from the collar arises the orange neck, concolorous with the hind head. In side-view the dorso-pleural suture is prominent; mesopleuræ blackish in front, on a triangular patch whose base is on the dorso-pleural suture; behind this it is very silvery, the silveriness being seen to lie in striæ if side-illumination be employed; the rest of the pleura is orange. In this view the darkened edge of the prothorax is seen projecting like a hood over the neck-collar. Another prominent object is a remarkable large rounded tubercle on the front aspect of the front coxa.

The *wings* have the venation as figured (fig. 16), the extreme base is orange, and all the veins are black. In Williston's paper (*op. cit.* pl. viii. fig. 27) the wing of the male *Paltostoma schineri* is figured; but an error is there made, inasmuch as the anal vein is omitted in the figure. Mr. F. W. Edwards has very kindly sent me a drawing of the wing of one of the paratypes of *P. schineri* in the British Museum, which is given in fig. 15, from which it will be seen that that species does possess a short, stout, anal vein. In all its structural details the wing agrees with that of the present female, including the close approximation of the first long vein to the costa, so that in vertical view the two appear contiguous, the space between being only visible in oblique view. It may here be noted that the wing of *P. superbiens* ('Novara Reise,' Taf. ii. fig. 4) differs considerably in detail: the well-marked anal angle of our present species is absent and the anal vein is long and fine.

The *halteres* are bright orange at the base and the elongate head is black, the two colours merging at the middle of the stalk.

Legs.—Relative lengths as in fig. 16. *Front*: coxa and trochanter pale; femur blackened except at the paler base (which has a conspicuous black spot in front), and a little ochreous just at the beginning of the swollen distal

end; tibia and tarsus similarly darkened. *Middle and hind*: coxa and femur pale, the latter with two broad ill-defined blackish bands, the one beyond the middle, the other a little remote from tip; tibia very slightly suffused, with an orange end-spine to hind pair. All the tarsi are blackened and bear bristly hairs; the claws are well developed, black, with a minute spine or accessory claw at the base of each.

Abdomen (figs. 16, 17).—Somewhat flattened sideways; viewed dorsally the segments are dull brown, darkened a little on the sharply defined distal margins; the segment before the genital ones has a fringe of longish yellow hairs. In side-view the segments are pale for about the proximal two-thirds, the rest is as the dorsum. The venter is strongly differentiated from the sides, ridged at each distal edge of a segment; the whole is densely scaled or pollinated, the raised distal margins being orange and brown, the depressed interspaces silvery. The lower genital segments are rather shining orange and chitinized, the upper ones are like the dorsum.

Length about $3\frac{3}{4}$ mm. *Wing-length* about $5\frac{3}{4}$ mm.

VII. GEOGRAPHICAL CONSIDERATIONS, AFFINITIES, ETC.

Three species of *Paltostoma* are known: *P. superbiens*, Schiner, from Colombia, known only in ♂ sex; *P. schineri*, Williston, the subject of this paper, St. Vincent and Trinidad, both sexes now known; and *P. bellardii*, Bezzi, from Mexico, known only in ♀ sex.

It is worthy of note that *P. schineri* occurs in both St. Vincent and Trinidad, though the two islands belong to completely different formations. St. Vincent is one of the volcanic chain of the Antilles, while Trinidad is merely a detached fragment of the South-American continent. St. Vincent is roughly 150 miles north of Trinidad, and there is an unbroken gap of nearly 90 miles between Trinidad and Grenada, the southernmost and nearest of the Antilles.

Bezzi (*op. cit.* 1913, p. 72), in mentioning the deductions which have been drawn from the geographical distribution of Blepharoceridæ, remarks that there are as yet many lacunæ in our knowledge, and that many additional forms will probably be brought to light in the great continental mountain-ranges and in those of many islands. The present writer would certainly endorse the opinion that this possibility exists. With reference to the Antilles in particular, any one who has viewed these mountainous islands, even

only in passing, or who has ridden for some hours among the precipitous mountains, dense forests, and countless swift streams of such an island as Dominica, must admit at least the *possibility* of fresh finds being made in them.

Assuming the *Paltostominæ* to be a natural group, then this group not only contains all the Neotropical representatives of the family (*Paltostoma*, *Kelloggina*, and *Curupira*), but is also represented in South Africa by the only *Blepharocera* known from that region (*Kelloggina barnardi*, Edwards, *op. cit.*), and in New Zealand by the genus *Neocurupira*, Lamb (*op. cit.*).

Affinities of the Larva.—The *Paltostoma*-larva, though agreeing with that of *Curupira* (as described by F. Müller) in its short 2-jointed antennæ, in having the dorsal surface spinose, and in having only one pair of lateral processes on the sixth segment, yet differs from it in having the branchial filaments disposed in tufts, not in series. It differs more widely from the *Curupira*-like larva from New Zealand described and figured by Chilton (*op. cit.*), and considered by Bezzi (*op. cit.* 1914) to be the larva of *Neocurupira*, for that larva not only has the branchial filaments disposed in series, but also has two pairs of lateral processes on the sixth segment.

On the other hand, the *Paltostoma*-larva has several points of resemblance with that of the South-African *Kelloggina barnardi*. There would be nothing surprising in this, as both forms belong to the same group, were it not for the difficulty that, according to Bezzi's tables of larval characters (*op. cit.* 1913, pp. 76–80), the larva of *K. barnardi* falls next to that of *Blepharocera fasciata*, Westw.: this being a member of a genus which differs widely from *Kelloggina* and *Paltostoma* in venation, in possessing dichoptic eyes, &c. Bezzi, remarking in a footnote (*op. cit.* 1913, p. 78) that the *Kelloggina*-larva falls in a group different from that to which the perfect insect appertains, suggests that the larva described as that of *K. barnardi* may really belong to an unknown species of a different genus. But, after examining the South-African material presented to the Cambridge Museum, I find this *not* to be the case. From one of the pupæ I have dissected a ♂ fly which is undoubtedly *K. barnardi*, thereby settling the determination of the pupæ. Also the only larva which I possess has the pupal respiratory horns already formed beneath its skin, and these agree in form with those of the pupæ: so there should be no reasonable doubt as to the identity of the larvæ. Therefore, the

larvæ and pupæ described as those of *Kelloggina barnardi* do really belong to that species.

This being established, one may return to the affinities of the *Paltostoma*-larva with the *Kelloggina*-larva. They agree in the form of the antennæ, the disposition of the branchial filaments in tufts, the form of the lateral processes (closely similar), and the presence of only one pair of processes on the sixth segment. But the *Kelloggina*-larva has no spines on its dorsal surface, only some weak ones on the lateral margins. In the possession of spines, the *Paltostoma*-larva approaches *Curupira*.

The writer is a little uncertain as to the importance attached to the disposition of the branchial filaments—whether in longitudinal series or tufts. Even when arranged in tufts, the filaments as seen under a high power (in *Paltostoma*, at least) do not arise co-basally, *i. e.* all from one point, but from a number of points. It is easy to imagine the pushing up together of a series to form a tuft, or conversely the spreading out of a tuft to form a series. While the arrangement provides a useful systematic character, perhaps too much weight should not be attached to it. If this be so, the larva described by F. Müller as *Curupira torrentium** is not widely removed from that of *Paltostoma*, the *Paltostoma*-larva being intermediate between it and *Kelloggina*.

The writer is at a loss to explain the apparent relationship of the *Kelloggina*-larva with that of *Blepharocera fasciata*. As he has not seen the larva of any species of the genus *Blepharocera*, and as the larvæ of species of that genus (according to Bezzi's tables) differ somewhat widely *inter se*, the question will not be discussed further here.

Affinities of Pupa.—So far as I am aware, the only published reference to a pupa covered with spiniform hairs, like that of *Paltostoma*, is given by Bezzi in a footnote on p. 30 of his work cited (1913). He there mentions such a pupa as sent from Brazil among a mixed lot of material. The pupa of *Kelloggina barnardi* is nude, and has the outer laminae of the respiratory horns much more bluntly pointed at the apex. The figure given by Müller (*op. cit.* pl. vii. fig. 6) shows respiratory horns apparently of much the same form as in *Paltostoma schineri*.

* These remarks are made on the assumption that the larva described by Müller, with only one pair of processes on the sixth segment, really is *Curupira*. That he undoubtedly had before him more than one kind is shown by his pl. iv. fig. 3, which illustrates a very different larva, having two pairs of processes on the sixth segment.

Affinities of Imago.—The writer has no special knowledge of the imago flies, and will only remark very briefly under this head. *Paltostoma* and *Kelloggina* are considered closely allied: Bezzi, referring (*op. cit.* 1913, p. 65) to the shortness of the proboscis in the ♀ of *Paltostoma*, states that this renders the distinction of the two genera very uncertain. But in the ♂ sex surely the form of the mouth-parts, even of the palpi alone, would distinguish the genus *Paltostoma*? The palpi being, as shown above, very short and at most 2-jointed in *Paltostoma* ♂, while they are long and 4-jointed in *Kelloggina* ♂. Osten-Sacken (*op. cit.* p. 167) remarked that *Kelloggina* (= *Snowia*) appeared to be closely allied to *Paltostoma*, but that it had a shorter proboscis and fully-developed palpi.

VIII. SUMMARY.

1. *Paltostoma schineri* was described from the ♂ sex only, from St. Vincent. ♀ ♀, larvæ, and pupæ have now been found in Trinidad, and are described here for the first time.

2. The larva has short 2-jointed antennæ; dorsal surface spinose; branchial filaments arranged in tufts; lateral processes simple, pediform, ciliate, without long setæ; sixth segment with only one pair of lateral processes.

3. In the full-grown larva there are ten branchial filaments, arising in five pairs, in each tuft. In the half-grown larva the number is much less. A similar increase during growth has been observed in *Liponeura*.

4. The larvæ and pupæ described as those of the South-African *Kelloggina barnardi* do actually belong to that species, in spite of doubts expressed on this point. The larvæ of *Kelloggina* and *Paltostoma* have a number of points of resemblance, and both differ from *Curupira* in the arrangement of the branchial filaments. But in the possession of dorsal spines *Paltostoma* approaches *Curupira*.

5. The pupa of *Paltostoma schineri* is characterized by the large number of erect spiniform hairs on its dorsal surface.

6. The mouth-parts of ♂ *Paltostoma* conform to the general Blepharocerid type, but are characterized by extreme length and slenderness of labrum, hypopharynx, and labium, and by extreme reduction of the palpi, which are minute and at most 2-jointed. The ♀ has a much shorter, stouter proboscis, and palpi normally developed.

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EXPLANATION OF PLATES IX.-XI.

[Figs. 1-14 drawn by H. S. with help of a Zeiss drawing-apparatus. Fig. 15 by F. W. Edwards (Brit. Mus.), with drawing-apparatus. Figs. 16, 17 by E. Wilson (Cambridge Univ. Press).]

LARVA.

- Fig. 1. Dorsal view. *e.*, eye; *e.s.*, eye-like spot; *p.*, pit; *m.a.*, *i.a.*, *l.a.*, median, intermediate, and lateral cephalic areas.
- Fig. 2. Ventral view of last two segments. *s.*=seventh, eighth and ninth spiracles.
- Fig. 3. Antenna.
- Fig. 4. Apex of same, more highly magnified.

PUPA.

Fig. 5. Dorsal view.

Fig. 6. Anterior outer lamina of left-hand respiratory horn, viewed from behind. *p.a.*, paler area.

Fig. 7. Inner laminae of left-hand respiratory horn, viewed from behind. *a.i.l.*, anterior inner lamina; *p.i.l.*, posterior inner lamina; *t.*, trachea, a fragment still attached under the chitinous wall of the body.

Fig. 8. Diagrammatic ground-plan of left-hand respiratory horn. *m.*, median longitudinal line of thorax; *a.o.l.*, *p.o.l.*, anterior and posterior outer laminae; *a.i.l.*, *p.i.l.*, anterior and posterior inner laminae; *s.*, spiracle.

IMAGO.

Fig. 9. Head and mouth-parts of ♂, mounted in balsam, the organs pushed apart by pressure. *labr.*, labrum; *hyp.*, hypopharynx; *mx.*, lobes of the two maxillae; *lab.*, labium.

Fig. 10. Right maxillary palpus of ♂, enlarged.

Fig. 11. Apex of ♂ hypopharynx, enlarged; the lateral fringes are doubled one over the other, so that the hairs projecting on the right side of the organ really arise from its left side, and *vice versa*.

Fig. 12. Apex of hypopharynx of *Kelloggina barnardi* ♂, to same scale as fig. 11, for comparison.

Fig. 13. ♂ genital armature from beneath, viewed as a transparent object.

Fig. 14. Terminal joint of hind tarsus and claws, ♂ (closely similar in ♀).

Fig. 15. Wing of ♂ (from one of Williston's paratypes).

Fig. 16. ♀, × 7: the pale reticulation shown on the abdomen is due to desiccation-shrinkage.

Fig. 17. ♀, head and body, × 7.

XIII.—*Descriptions of new Freshwater Fishes from Sierra Leone.* By G. A. BOULENGER, F.R.S.

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A SMALL collection of fishes made at Matca, Sierra Leone, by Mr. N. W. Thomas, and presented by him to the British Museum, contains examples of three species previously known, viz. *Marcusenius brachistius*, Gill, *Fundulus sjoestedti*, Lönnb., *Haplochilus macrurus*, Blgr.; and of four which I regard as new to science, viz. an *Eleotris* allied to *E. kribensis*, Blgr., which will be described in the forthcoming third volume of the 'British Museum Catalogue,' and the following, referable to the genera *Barbus*, *Haplochilus*, and *Paratilapia*.

Barbus leonensis.

Depth of body equal to length of head, $3\frac{1}{4}$ times in total length. Snout rounded, shorter than eye, which is 3 times in length of head and a little less than interorbital width; mouth small, terminal, with feebly developed lips; no barbels. Dorsal III 7, equally distant from posterior border of eye and from caudal, border straight; last simple ray not enlarged, not serrated, slightly shorter than head. Anal III 5, not reaching caudal. Pectoral shorter than head, not reaching ventral; latter below origin of dorsal. Caudal forked. Caudal peduncle $1\frac{1}{3}$ times as long as deep. Scales radiately striated, 21-23 $\frac{4\frac{1}{2}}{3\frac{1}{2}}$, 2 between lateral line series and ventral, 8 round caudal peduncle; lateral line present only in front, reduced to 7 tubules. Yellow, with black dots on the borders of the dorsal scales; a black spot on the dorsal fin and another at the base of the caudal.

Total length 21 mm.

Two specimens.

Closely allied to *B. jae*, Blgr.

Haplochilus annulatus.

Depth of body 5 times in total length, length of head $3\frac{1}{2}$ times. Head flat above; snout a little shorter than eye; mouth directed upwards, lower jaw projecting; eye $2\frac{2}{3}$ times in length of head, $1\frac{1}{3}$ times in interorbital width; præorbital very narrow. Dorsal 7, originating twice as far from occiput as from root of caudal, above posterior fourth of anal, produced, longest ray as long as head. Anal 13, produced like the dorsal. Pectoral a little shorter than head, extending beyond base of ventral; latter small. Caudal pointed, median rays produced, longer than head. Caudal peduncle $1\frac{2}{3}$ times as long as deep. 28 or 29 scales in longitudinal series; lateral line represented by an interrupted series of pits. Lemon-yellow, with four broad black rings, the first round the head, the last round the caudal peduncle; dorsal and anal yellow, with the anterior rays black; caudal orange, with two dark purple longitudinal lines.

Total length 16 mm.

Two specimens.

Appears most nearly related to *H. chevalieri*, Pellegr.

Paratilapia thomasi.

Depth of body 2 to $2\frac{1}{3}$ times in total length, length of head $2\frac{3}{4}$ to $3\frac{1}{4}$ times. Head twice as long as broad; snout with convex upper profile, broader than long, $\frac{1}{2}$ to $\frac{2}{5}$ postocular part of head; eye $3\frac{1}{3}$ to $3\frac{1}{2}$ times in length of head, 1 to $1\frac{1}{3}$ times in interorbital width, greater than præorbital depth; mouth rather small, extending to between nostril and eye; præmaxillary processes short; teeth small, in 3 or 4 series; 3 or 4 series of scales on the cheek, width of scaly part a little less than diameter of eye. Gill-rakers short, 7 or 8 on lower part of anterior arch. Dorsal XIV 9-10; spines increasing in length to the last, which measures $\frac{2}{3}$ to $\frac{1}{2}$ length of head; longest soft ray nearly as long as head. Anal III 7-8; third spine a little shorter than last dorsal. Pectoral a little shorter than head, not extending to vertical of origin of anal. Ventral much produced, extending beyond origin of anal. Caudal rounded. Caudal peduncle deeper than long. Scales very feebly denticulate, $25-27\frac{2}{10}$; lateral lines $\frac{15-16}{6-10}$. Yellowish, with six black cross-bands, the third of which may expand into a rhombic spot; a black bar from the eye to the mouth; a black opercular spot, with or without small pearl-white spots; dorsal and anal fins grey, the former edged with white; outer rays of ventral black.

Total length 65 mm.

Three specimens.

Appears most nearly related to *P. dorsalis*, Pellegr. As in *P. codringtoni*, Blgr., the maxillary bone is concealed when the mouth is closed, the fish having the appearance of a *Tilapia*.

The exploration of the freshwater fauna of Sierra Leone has not received much attention. The number of species of fishes with which I am acquainted amounts only to eighteen:—*Polypterus palmas*, Ayres, *Protopterus annectens*, Ow., *Maracusenius brachistius*, Gill, *Notopterus afer*, Gthr., *Alestes onqipinnis*, Gthr., *Barbus leonensis*, Blgr., *Clarias liberiensis*, Stdr., *Fundulus sjoestedti*, Lönnb., *Haplochilus fasciolatus*, Gthr., *H. chaperi*, Sauv., *H. macrurus*, Blgr., *H. annulatus*, Blgr., *Paratilapia thomasi*, Blgr., *Hemichromis fasciatus*, Peters, *H. bimaculatus*, Gill, *Eleotris lebretoni*, Stdr., *E. leonensis*, Blgr., and *Mastacembelus reticulatus*, Blgr.

XIV.—*Notes on Carides*. By L. A. BORRADAILE, M.A.,
Lecturer on Zoology in the University of Cambridge ;
Fellow, Dean, and Lecturer of Selwyn College.

DURING the investigation of certain collections of prawns from the Indo-Pacific region I have arrived at the following conclusions, which appear to be worth putting on record in a preliminary statement.

I. THE CRANGONOIDA.

The bounds of this superfamily must be enlarged to admit the genera *Anchistioides*, Paulson, 1875, *Amphipalæmon*, Nobili, 1901, and *Hymenocera*, Latr. This addition involves two concessions in the definition of the group : (1) if *Anchistioides* and *Amphipalæmon* are to be admitted, it can no longer be stated that the mandible is always without incisor-process ; (2) the inclusion of *Hymenocera* makes it necessary to allow the persistence of a small representative of the outer lacinia of the maxilla.

Anchistioides and *Amphipalæmon* constitute a new family, the Anchistioididæ, intermediate between the Crangonoida and the Palæmonoida. The principal characteristics of this family are : (1) a well-developed, compressed, toothed rostrum ; (2) a short, thick, accessory flagellum on the antennule ; (3) a deeply cleft mandible without palp ; (4) the absence of "laciniae" from the maxilla ; (5) the absence of the exopodite from the third maxilliped ; (6) an *appendix interna* on the first abdominal limb ; (7) considerable variability in the armature of the telson ; (8) a gill-formula consisting of pleurobranchs for the legs, an arthrobranch for the third maxilliped, and epipodites (mastigobranchs) on the maxillipeds.

Hymenocera is shown by its mouth-parts to belong to the Gnathophyllidæ. The species described by Balss as *H. ceratophthalma* deserves to become the type of a new genus. I have called this genus *Phyllognathia*, and placed it also in the Gnathophyllidæ. The principal characteristics of that family are now as follows :—(1) a compressed dentate rostrum ; (2) the outer flagellum of the antennule thick at the base and cleft for a very short distance ; (3) the mandible simple, slender, curved, palpless ; (4) the inner "lacinia" of the maxilla lost, the outer either lost or very small but still cleft ; (5) the third maxilliped with exopodite, simple mastigobranch, and endopodite of *four* joints, some or all of which

are greatly broadened ; (6) the telson with two pairs of spines at the sides, and at the end an outer short and an inner longer pair of spines, a submedian pair of slender feathered spines, and a median pointed projection ; (7) a gill-formula comprising pleurobranchs for the legs, an arthrobranch for the third maxilliped, and in *Hymenocera* the vestige of a pleurobranch for the latter limb, with epipodites on the maxillipeds only.

II. THE PALÆMONIDÆ.

There must be recognized in this family four subfamilies, separated as follows :—

- I. None of the bristles at the end of the larval telson become in the adult transposed on to the anterior part of that organ, which is therefore unarmed on back and sides. The surface of the molar process of the mandible is closely ridged. [There is a pleurobranch for the third maxilliped.] *Desmocaridinæ*.
- II. Two pairs of the bristles at the end of the larval telson become in the adult transposed on to the back of that organ. The surface of the molar process of the mandible bears some half-dozen large knobs or crests.
 - A. The end of the telson bears six spines. [There is no pleurobranch to the third maxilliped.] *Pontoninæ*.
 - B. The end of the telson bears four spines.
 1. The side of the carapace is traversed by a suture. The outer flagellum of the antennule is but slightly cleft. There is no pleurobranch to the third maxilliped. *Typhlocaridinæ*.
 2. The side of the carapace has no suture. The outer flagellum of the antennule is deeply cleft. There is a pleurobranch to the third maxilliped. *Palæmoninæ*.

III. DEFINITIONS OF NEW GENERA.

1. *Lysmatella* (Hippolytidæ).

Related to *Lysmata*, but without mastigobranchs on the legs.

2. *Phyllognathia* (Gnathophyllidæ).

Ischium of third maxilliped narrow and movably sutured to merus. Mandible subcylindrical. Lacinia of maxillæ lost. Outer flagellum of antennule normal. Rostrum of a good length.

3. *Urocaridella* (Pontoniinæ).

Body very slender and compressed. Thorax without dorsal swelling. Sixth abdominal segment elongate. Rostrum long, upcurved, toothed above and below. Outer flagellum of antennule deeply cleft. Antennal scale long, narrow. Mandible with two-jointed palp. Second maxilliped with podobranch. Third maxilliped narrow, five-jointed, with arthrobranch.

4. *Pontoniopsis* (Pontoniinæ).

Body graceful, but not much compressed. Thorax without dorsal swelling. Sixth abdominal segment short. Rostrum rather short, depressed, lanceolate in dorsal view, toothless. Outer flagellum of antennule moderately cleft. Antennal scale of good breadth. Mandible without palp. Second maxilliped without podobranch. Third maxilliped with vestigial arthrobranch. Eyes spherical.

5. *Periclimenæus* (Pontoniinæ).

Body rather stout; cephalothorax deep, a good deal compressed; abdomen evenly curved. Thorax without dorsal swelling. Rostrum rather short, compressed, toothed above only. Outer antennular flagellum not deeply cleft. Antennal scale of good breadth. Mandible without palp. Second maxilliped without podobranch. Third maxilliped narrow, with vestigial arthrobranch.

IV. DEFINITIONS OF NEW SUBGENERA.

The species of *Periclimenes* fall into four groups, as follow:—

- | | |
|--|--------------------|
| I. Rostrum toothless. No spines on trunk and legs | <i>Ensiger</i> . |
| II. Rostrum toothed. Spines at certain points on trunk and legs. | |
| A. Cornea ogival. [Upper edge of rostrum convex. Strong supraorbital spine.] | <i>Corniger</i> . |
| B. Cornea not ogival. | |
| 1. Upper edge of rostrum convex. Second leg with short wrist, and unarmed save in one species. Supra-orbital spine in one species only | <i>Cristiger</i> . |
| 2. Upper edge of rostrum straight or concave. Second leg rarely with short wrist, generally with spine on wrist or arm or both. Supraorbital spine common .. | <i>Falciger</i> . |

V. DEFINITIONS OF NEW SPECIES.

1. *Pandalus (Plesionica) gracilis*.

Rostrum long, gently upcurved from base, bearing above two strong teeth on a crest over the eye and eight spinules, below a row of small sharp teeth. Eye wider than stalk, with distinct ocellus. First leg simple and sparsely hairy. Second wrist 9-jointed. Third abdominal tergum not produced into spine.

Western Indian Ocean, 200 fath.

2. *Heterocarpus unicarinatus*.

Related to *H. longirostris*, MacGilchrist, 1905, but without the hinder three-quarters of the antennal carina.

Providence I., 637-665 fath.

3. *Heterocarpus affinis*.

Related to *H. alphonsi*, Bate, 1888, but has (1) the rostrum much more strongly upcurved, (2) fewer joints in the second wrists, (3) walking-legs considerably longer than the antennal scale.

Saya de Malha, 300-500 fath.

4. *Thalassocaris affinis*.

Related to *T. lucidus* (Dana), 1852, but has (1) the rostrum less strongly recurved, (2) stronger teeth on the antennal scale, (3) the second hand shaped as in *T. crinitus*.

Maldives and Saya de Malha.

5. *Thalassocaris maldivensis*.

Rostrum at first descending and then horizontal, outreaching antennal scale, $\frac{7-8}{2}$, two teeth behind orbit. Suborbital and antennal spines only. Antennal scale without teeth. Second leg feeble and simple. No spine on third abdominal tergum.

Maldiv Is.

6. *Thor maldivensis*.

Rostrum very short, with one tooth above and none below. Supraorbital and antennal spines present. First leg in female stout, simple, and shorter than third maxilliped, in male as long as body, granulate, stout, but with chela no stouter than rest of limb, arm and hand subequal, fingers one-quarter length of palm, on which they are bent inward, each

bearing a low tooth. Second wrist 5-jointed, the second joint larger than the others. Last three legs alike in both sexes.

Minikoi, Maldives, Salomon.

7. *Lysmata affinis*.

Related to *L. seticauda* (Risso), 1816, and *L. chiltoni*, Kemp, 1914, but (1) rostrum reaches beyond eyes, ends before middle of second joint of antennule, and has formula $\frac{5-6}{2-3}$, lower teeth small, but larger than in *L. chiltoni*, (2) pterygostomial angle subrectangular and usually produced into spinule, (3) first leg slightly outreaches antennal scale, but falls considerably short of end of third maxilliped.

Minikoi, Peros Banhos, Salomon, Seychelles.

8. *Lysmatella prima*.

Body compressed. Rostrum $\frac{8-11}{5-9}$, straight but upcurved at end, outreaching antennular stalk. Third maxilliped as stout as first leg, in which hand and arm are subequal, wrist a little shorter. Second wrist has 20-22 joints, the last the longest.

Maldivé Is.

9. *Amphipalaemon gardineri*.

Rostrum very deep, straight at base, outreaching antennal scale. Telson bears two pairs of spines on the dorsal side and at the hind end one stout pair of spines and a pair of feathered bristles.

N. Malé Atoll, Maldivé Is.

10. *Amphipalaemon cooperi*.

Rostrum not very deep, arched at base, reaching end of antennal scale. Telson as in *A. gardineri*, but with hinder pair of dorsal spines farther back. Meropodite of second leg $\frac{6}{7}$ of length of hand.

S. Nilandu Atoll, Maldivé Is.

11. *Nikoides maldivensis*.

Related to *N. danae*, Pauls., 1875, but has (1) rostrum of quite different shape, the dorsal tooth being larger and placed much farther back, (2) exopodite of first leg relatively shorter, (3) wrists of first legs equal, (4) no spines on ischiopodite or meropodite on last three legs.

Maldivé Is.

12. *Ægeon rugulosum*.

Related to *A. medium* (Alc. & And.), 1899, but has (1) the beading of the ridges of the carapace much coarser, (2) no tooth on either side of base of rostrum, (3) the large spine near the pterygostomial angle placed at the end of the supra-marginal, not lateral, ridge.

Western Indian Ocean.

13. *Urocaridella gracilis*.

Rostrum $\frac{8-10}{10-12}$, nearly twice as long as carapace. Antennal and hepatic spines present. Antennular stalk three-quarters length of antennal scale. Latter not half length of rostrum, subtruncate, its distal spine not projecting. First leg outreaching antennal scale by fingers. Second legs equal and similar, unarmed, outreaching antennal scale by hand and part of wrist.

Maldivé Is.

14. *Palæmonella elegans*.

Related to *P. tridentata*, Borr., 1899, but with rostrum lanceolate, not reaching end of first joint of antennæ, its formula $\frac{3}{0}$.

Salomon I.

15. *Palæmonella longirostris*.

Rostrum $\frac{8}{3}$, outreaching antennular stalk by nearly half its own length, upcurved. First wrist half as long again as its hand. Arm of second leg of even width throughout.

Fardiffolu Atoll, Maldivé Is.

16. *Periclimenes (Cristiger) frater*.

Related to *P. soror*, Nobili, 1904, but (1) teeth on upper edge of rostrum closer set towards tip, (2) two distal spines on first joint of antennule, (3) antennal scale decidedly outreaches first leg, (4) no accessory denticle on dactylopodites of last three legs.

Seychelles.

17. *Periclimenes (Cristiger) incertus*.

Related to *P. parvus*, Borr., 1898, but (1) body more slender, (2) rostrum shallower, (3) a denticle on carapace behind beginning of rostral crest, (4) penultimate joint of third maxilliped longer than end-joint.

Maldivé Is.

18. *Periclimenes (Cristiger) commensalis*.

Rostrum $\frac{5}{2}$, lanceolate, reaching end of antennular stalk, no tooth behind orbit. Supraorbital, hepatic, and antennal spines present. Two distal spines on first joint of antennule.

Torres Straits, on *Comanthus annulatus*.

19. *Periclimenes (Corniger) cornutus*.

Rostrum $\frac{7}{1}$, deep, lanceolate, outstretched by antennal stalk. Eye without papilla.

Malé Atoll, Maldive Is., on crinoid.

20. *Periclimenes (Corniger) ceratophthalmus*.

Rostrum $\frac{4}{0}$, shallow, lanceolate, outreached by antennal stalk. Eye with papilla at apex.

Malé Atoll, Maldive Is., on crinoid.

21. *Periclimenes (Falciger) nilandensis*.

Rostrum $\frac{9}{4}$, outreaching antennular stalk distinctly and antennal scale barely, its upper edge gently concave from the base. Supraorbital, antennal, and hepatic spines present. Antennal scale broad, with distal spine not projecting beyond end. Second legs unequal, unarmed.

S. Nilandu Atoll, Maldive Is.

22. *Periclimenes (Falciger) affinis*.

Rostrum $\frac{7}{2}$, outreaching antennular stalk but not antennal scale, straight at first, then gently upcurved, its tip simple. Supraorbital, antennal, and hepatic spines present. Outer edge of long joint of third maxilliped bears several spines. Second leg with two spines and a blunt tooth at end of wrist, fingers toothed, about one-third length of palm, wrist nearly twice length of fingers.

Salomon I.

23. *Periclimenes (Falciger) dubius*.

Related to *P. affinis*, but (1) rostrum $\frac{8}{4}$, its tip bifid, (2) in second leg, wrist and arm stouter, and fingers about equal to wrist, more than half length of palm.

Minikoi.

24. *Periclimenes (Falciger) compressus.*

Rostrum $\frac{5}{3}$, rather shallow, straight at first but slightly upturned at end. Antennal and hepatic spines alone present. Second leg unarmed, with short wrist, outreaching antennal scale by hand.

Saya de Malha.

25. *Periclimenes (Falciger) brockettii.*

Rostrum $\frac{6}{1}$, straight, shallow, directed somewhat downwards, reaching end of antennal scale, and slightly outreaching antennular stalk. Antennal and hepatic spines alone present. Two distal spines on first joint of antennule. Second leg unarmed, with rather short wrist, slender hand, and simple fingers.

Malé Atoll, Maldive Is., on brown crinoid.

26. *Periclimenes (Falciger) pottsi.*

Rostrum $\frac{7}{2}$, reaching end of antennal scale, outreaching antennular stalk, its upper edge curving very slightly downward from the base and more strongly upwards near the tip. Hepatic and antennal spines alone present. Last two joints of antennular stalk slender. Antennal scale narrow, longer than carapace, its distal spine projecting beyond its end. Second wrist bears a spine.

Torres Straits, on *Comanthus*.

27. *Periclimenes (Falciger) suvadiensis.*

Rostrum $\frac{6-7}{2}$, outreaching antennular stalk, outreached by antennal scale, straight except at the tip, which is gently upcurved. Hepatic, antennal, and suborbital, but no supra-orbital spines present. Last two joints of antennular stalk stout. Antennal scale narrow, shorter than carapace, its distal spine projecting beyond its end. Second wrist bears a spine.

Suvadiva Atoll, Maldive Is.

28. *Periclimenes (Falciger) seychellensis.*

Rostrum $\frac{7-8}{3}$, deep, its upper edge decidedly concave from base, outreaching antennular stalk. Antennal and hepatic spines alone present. Antennal scale rather broad, its distal spine projecting beyond its end. Second legs equal, unarmed, palm and fingers subequal.

Praslin, Seychelles.

29. *Periclimenes (Falciger) kolumadulensis*.

Related to *P. borradailei*, Rathb., 1904 (= *P. tenuipes*, Borr., 1898), but (1) rostrum $2\frac{1}{2}$ times length of carapace, (2) second leg 7 times length of carapace, (3) second legs unlike, one with fingers gaping very widely.

Kolumadulu Atoll, Maldive Is.

30. *Pontoniopsis comanthi*.

Rostrum reaching end of second joint of antennule, its breadth about equal to that of eye. Antennal scale outreaching antennular stalk, broad. Arm and wrist of first leg subequal. Great chela outreaching antennular stalk by hand, its wrist very short and wide, with a sharp process below.

Torres Straits, on *Comanthus*.

31. *Periclimenæus fimbriatus*.

Rostrum $\frac{4-7}{0}$, without teeth behind orbit. Fixed finger of second leg bears knob and movable finger a socket. Fingers of uropods, scales, &c., very long.

Mulaku Atoll, Maldive Is.; Providence.

32. *Periclimenæus robustus*.

Rostrum $\frac{9}{0}$ with two teeth behind orbit. Movable finger of second leg bears knob and movable finger a socket. Fringes not remarkably long.

Amirante I.

33. *Pontonia maldivensis*.

Rostrum reaches middle of first joint of antennule. Maxillipeds without exopodites. Second legs unequal, the larger about twice as long as carapace, with long, parallel-sided hand. Dactylopodites of last three legs simple.

Fadiffolu Atoll, Maldive Is.

XV.—*New Dragonflies (Odonata) of the Subfamily Libellulinae from Sierra Leone, W. Africa.* By Dr. F. RISE, Rhododendron, Switzerland.

THE following descriptions have been extracted from proof-sheets and manuscript of the writer's 'Monograph of the Libellulinae' (Collections Selys, fasc. ix.-xvi.). By the kindness of Mr. Herbert Campion I was enabled to examine

a great number of very interesting Libellulinae, collected for the Imperial Bureau of Entomology (formerly the Entomological Research Committee, Tropical Africa) in Nigeria, Sierra Leone, and British East Africa. Many records from the earlier consignments, especially those from Nigeria, were entered in the main text of the monograph and published. Others arrived too late for that purpose, but in good time for the "Additions," which, together with the indices, were due to be issued in 1914, being the last instalment of the monograph. The lamentable situation in Europe generally, and in Belgium especially, leaves us little hope of seeing that last part published in the near future. In the beautiful collection sent home from Sierra Leone by Dr. J. J. Simpson there were four new species, one of them representing an interesting new genus. Instead of separate publication, which was originally discussed, insertion of the novelties in the monograph was preferred, upon the assumption that the "Additions" would appear without any long delay. But under the changed conditions of to-day, separate publication was again considered, and decided upon. Mr. H. Champion has kindly read the descriptions for correctness of language, they being the author's own translation from the original German text.

All the type-specimens have been presented by the Imperial Bureau of Entomology to the British Museum (Natural History).

Allorhizucha campioni, sp. n.

2 ♂, 2 ♀, Sierra Leone; Ka Yima, Kangama, Gigbema, Dumballa, 24, 29.vi., 22.viii., 7.ix. 1912 (*Dr. J. J. Simpson*).

Closely allied to *Allorhizucha klingi*, Karsch, but differing in the following details:—(a) greater number of cubito-anal cross-veins (Cuq), 4 in front wing, 3 in hind wing; (b) at the humeral suture a narrow interrupted light green line; (c) the greenish-yellow stripes on the sides of the thorax a little narrower, slightly concave instead of straight at anterior margin; (d) abdomen of male distinctly fusiform; (e) superior appendages a little longer; (f) slight difference in genitalia of second segment, the internal branch of the hamule being more erect (nearly as figured in Lib. fig. 52 for *A. preussi*, Karsch). Minute as these differences are, they appear sufficient in their totality to justify specific distinction, the more so as there are specimens brought by Dr. Simpson, also from Sierra Leone, that agree perfectly with *A. klingi*, as described in Lib. p. 81. The interesting

species is named after Mr. Herbert Campion, who first observed its peculiar features.

♂ (adult).—Labium light yellow, with a broad median black stripe. Labrum black. Face light greenish yellow. Frons metallic greenish blue, light yellowish at antero-lateral angles. Vertex metallic greenish blue, broadly convex, very slightly emarginate. Prothorax black, a median spot and the vertically erect margin of posterior lobe greenish yellow. Thorax deep black, with light yellowish-green markings:—a narrow line at each side of median suture; in front of humeral suture a narrow dorsal dot and a point in middle of suture itself; two broad lateral stripes, first one from the metastigma to a little more than halfway to humeral suture, second one on posterior two-thirds of metepimeron, of which the posterior ventral angle remains black; anterior margin of both stripes slightly concave, of first one near dorsal end, of second one in middle. Ventral surface dull greenish grey, sutures lined with black. Legs robust, black; first femora yellow internally. Third femora with very numerous, about 30, very small, regular, triangular denticles; second femora with similar, but still more closely arranged and gradually lengthening denticles. Spines of tibiæ rather robust, about 10 on third tibiæ. Teeth of tarsal claws robust, remote from end. Abdomen relatively short, slender; basal segments slightly widened laterally and dorso-ventrally; 3-5 very narrow; 6-8 with slight fusiform dilatation. Black, with yellow markings: on segment 1 a broad lateral and small, triangular, postero-dorsal spot; on 2 a large lateral U-shaped spot and mid-dorsal, posteriorly narrowed stripe; on 3 a lateral stripe, narrowly interrupted at the transverse carina; on 4 two small lateral spots on anterior half; on 5 a small antero-lateral spot; 6 wholly black; 7 with a large elliptical spot on each side, extending over the entire width and three-fourths of the segment's length; 8-10 black. Ventral surface black, with yellowish median spots on segments 3-7. Superior appendages about as long as ninth and tenth segments together, a little longer than in *A. klingi*, but scarcely different in form. Inferior appendage very little shorter than superiors. Genitalia of second segment: hamule generally as in the other two species, internal branch very thin, almost vertical; lobe narrowly elliptical, of about equal height as the hamule.

Wings slightly stained with greyish yellow, golden yellow at base: in front wing a vestige in σ sc. and cu., in hind wing

* For an explanation of the terminology employed by Dr. Ris in describing the veins and spaces in the wings of Libellulinae, see that author's monograph of the subfamily, fasc. ix. pp. 14-16.—H. C.

sc. to Anq. 1, cu. to Cuq. 1, 2-3 cells in anal area. Anq. 14.14; Cuq. $\frac{3.4}{3.3}$; t. $\frac{0.0}{0.1}$; ti. 1.0; ht. $\frac{1.1}{1.1}$; Bqs. $\frac{2.2}{2.2}$; second specimen: Anq. $14(\frac{1}{2})$.14; Cuq. $\frac{5.4}{3.3}$; t. $\frac{0.0}{1.1}$; ti. 0.0; ht. $\frac{1.1}{1.1}$; Bqs. $\frac{2.3}{2.2}$; in both specimens discoidal area with a single row to near end and not widened.

♀.—Markings as in male, only there is also an antero-lateral yellow spot on segment 6. Genital segments not in good condition; they appear scarcely distinct from *A. klingi*.

Wings rather deeply stained with greyish yellow, especially along the veins; yellow basal stripes slightly larger than in male. Anq. 15.15; Cuq. $\frac{4.4}{3.3}$; t. $\frac{0.0}{1.1}$; ti. 1.0; ht. $\frac{1.1}{1.1}$; Bqs. $\frac{2.2}{2.2}$; in discoidal area of front wings on right side one row of cells to the level of the bridge, then two rows; on left side two cells twice at beginning, afterwards as on right side; scarcely more widened to wing's edge than in male. Second specimen: Anq. 15.15; Cuq. $\frac{4.5}{4.3}$; t. $\frac{0.0}{1.1}$; ti. 1.1; ht. $\frac{1.1}{1.1}$; Bqs. $\frac{2.3}{2.3}$; discoidal area in front wing, right side two rows from the beginning, left side at first one cell and a half, followed by two rows.

♂. Abd. 21.5, hw. 25, pt. >2. ♀. 21, 25, >2.

Orthetrum sagitta, sp. n.

1 ♂, 1 ♀, Sierra Leone, Port Lokko, 2, 3. v. 1912 (Dr. J. J. Simpson).

Nearest to *O. africanum*, Selys, but smaller; abdomen not longer than wings, fourth segment not considerably elongate, not fully 5 mm. (7 mm. in *africanum*); internal branch of hamule considerably higher than external branch (of about equal height in *africanum*). Antenodal cross-veins black in sc.; pterostigma dark; very slender species; segments 1-3 much inflated, globose, 4-10 very narrow, parallel; mostly 1 row of cells Rs.-Rspl.

♂.—Labium light yellow. Labrum light yellow, very narrowly lined with black at free margin. Face and frons anteriorly light greenish yellow; frons above obscure olivaceous, but narrowly and indistinctly brown at base. Vertex dull brownish. Thorax dull greenish, with fine elevated black points and the following dark lines, black on dorsum, brown and somewhat diffuse at sides: complete and rather broad line at median suture; about equally broad, dorsally truncate line a little nearer to humeral than to median suture; complete line at humeral suture, somewhat diffusely invading space between suture and antehumeral black line;

three lateral lines: (1) a little in front of metastigma, (2) across metastigma, (3) on second lateral suture. Ventral surface dull ferruginous, with thin whitish pruinosity. Legs black, first femora yellow internally, second and third femora greenish brown in basal half. Abdominal segments 1-3 inflated, almost spherical (but rather considerably smaller than in *africanum*); 4-10 very slender, parallel. Segment 1 dull greenish, obscure dorsally; 2 similar, but dark lining of carinae broader and confluent in posterior half of dorsum; 4-6 black, on each side, slightly behind the middle, a yellow spot, distant by about its own length from end of segment and not fully touching mid-dorsal carina; 8-10 wholly black. Ventral surface 1-3 dull greenish, with carinae narrowly black; 4-8 black, with submedian yellowish spot, large on 4, successively smaller posteriorly. Genitalia of second segment: anterior lamina moderate, depressed; convexity of basal part flat, with many minute black spines; a very small notch at end. Hamule small; internal branch a robust triangular hook, but slightly curved sideways, very little higher than anterior lamina; external branch appreciably shorter, separated by a narrow incision of very moderate depth, broadly rounded. Lobe large, almost circular in outline.

Wings slightly stained with greyish from the triangular region outwards; minute vestige of yellow in cu. of hind wings. Membranule black. Pterostigma dark ferruginous, between strong black veins. Venation wholly black; only a very narrow dull yellowish line at the costa anteriorly. Arculus a little distal to Anq. 2. Anq. 13.13; t. $\frac{1.1}{0.0}$; ht. $\frac{1.1}{0.0}$; 1 row Rs.-Rspl. Abd. 30, hw. 30, pt. < 3, length of fourth segment 5 mm.

♀.—Almost entirely similar to male in shape, colour, and pattern. Lateral brownish lines of thorax lighter and narrower. Abdomen but little more robust; foliaceous dilata-tions of segment 8 very narrow; vulvar scale not visible. Appendages black, very acute; supra-anal tubercle and sub-anal valves light yellowish.

Minute vestige of yellow in cu. and in anal area of front wings, slightly more yellow in hind wings: vestige in sc., in cu. halfway to Cuq., one cell at membranule. Anq. 14.15; doubled cells in Rs.-Rspl. $\frac{1.2}{2.0}$; venation otherwise as in male. Abd. 29, hw. 30, pt. 3, length of fourth segment < 5.

CYANOTHEMIS, gen. nov.

Facies of *Hadrothemis*, but differing in the position of the

arculus (proximal to second antenodal) and in the configuration of the eyes, the posterior lobe of the prothorax, and the genital segments in female.

Type of venation between *Crocothemis* and *Bradinopyga*; differing from both by configuration of eyes and of posterior lobe of prothorax.

In regard to eyes and prothorax nearest to *Rhodothemis*. Spines of legs not so markedly differentiated as in *Rhodothemis*. More important differences from that genus: (1) discoidal area in front wing with 3 rows of cells to level of nodus, (2) Cu_1 in hind wing at anal angle of t., (3) 2 rows Rs.-Rspl., (4) 4-5 rows between A_3 and wing's edge in hind wing, (5) last Anq. in hind wing incomplete, apparently an almost regular and therefore very curious feature.

Cyanothemis will find its place in our systematic arrangement of Libellulinae immediately preceding *Rhodothemis*.

Head moderate; eyes meeting scarcely more than in a point; occipital triangle very large. Frons very prominent, rounded, without anterior ridge, and not flattened anteriorly; furrow moderate. Vertex broadly convex, very slightly emarginate.

Posterior lobe of prothorax large, erect, divided into two rounded lobes, ciliate. Thorax robust. Legs comparatively short, robust. Male with third femora armed in proximal two-thirds with about 10 moderately robust spines, increasing in length very gradually, 3-4 longer spines at end; second femora with about 7 small, gradually lengthening and 2 terminal long spines. Spines of tibiae long and robust, 8-9 on third tibiae. Teeth of tarsal claws robust, in distal third.

Abdomen rather short, relatively broad, depressed; moderately widened at base dorso-ventrally, very gradually narrowed to end. No distinct transverse carina on fourth segment. Genitalia of second segment small, the hamule with regular external branch. For genital segments of female see under the species.

Wings long, reticulation serrate. t. in front wing on a level with t. in hind wing. Sectors of arculus with a long common stalk in both wings. Arculus between Anq. 1 and 2. Cu_1 in hind wing at anal angle of t. Anq. $12\frac{1}{2}$ - $14\frac{1}{2}$, last Anq. incomplete in hind wing as well. Proximal side of t. in hind wing at arculus. 1 Cu_1 in all wings; no Bqs. t. in front wing narrow, crossed. t. in hind wing crossed; ht. free; ti. in front wing 3-celled. M_2 feebly double-curved. 2 rows Rs.-Rspl. Cu_1 in front wing strongly convex; discoidal area considerably widened to end; 3 rows to level of nodus. 1 row M_4 -Mspl. Anal area of hind wing broad.

Interpolated cells at anal angle of t. and external angle in anal loop; A_2 moderately angulated. 4-5 rows between A_3 and edge in hind wing, conspicuously arranged in transverse rows. Membranule moderate. Pterostigma small.

Cyanothemis simpsoni, sp. n.

Collected for the Imperial Bureau: 1 ♂, Sierra Leone, Yana, 1. iv. 1912; 1 ♂, S. L., Mongheri, 15. ix. 1912 (*Dr. J. J. Simpson*). Collection of Brit. Museum: 1 ♂, 1 ♀, Southern Nigeria, Oshun Bridge, Oshogbo, i.-iii. 1913 (*Dr. H. Strachan*).

♂ (adult, Yana).—Labium black, at antero-lateral angle of lateral lobe a brownish spot. Labrum, face, and frons anteriorly brownish black. Frons above brilliant sky-blue. Vertex at base and anteriorly black, sky-blue above. Occipital triangle light blue, narrowly lined with whitish. Prothorax black, upraised posterior lobe light blue. Thoracic dorsum brilliant sky-blue from narrow black line on median suture to slightly more than halfway to humeral suture, including antealar sinus; otherwise blackish. Sides very dark reddish brown; ventral surface blackish brown, very slightly bluish pruinose. Legs brownish black. Abdominal segments 1-2 black, 3-7 dull bluish (sky-blue in living insect?), 8-10 black. Ventral surface black, moderately whitish pruinose. Appendages small; superiors distant at base, convergent, ending rather abruptly in an acute point; in side-view obliquely cut at end, no distinct inferior angle, about 12 small irregular denticles; inferior appendage broad, more than three-fourths the length of superiors. Genitalia of second segment: anterior lamina depressed, broadly elliptical, ciliate. Hamule small, depressed posteriorly; external branch triangular, acute, directed laterally; internal branch a small fine hook, strongly curved laterally. Lobe long and narrow, strongly depressed posteriorly, slightly higher than hamule (the entire structure of the type found in *Crocothemis* and *Rhodothemis*).

Wings hyaline, very narrowly and diffusely lined with greyish at tips. Deep blackish brown basal spots: in front wing in sc. and cu. not fully to Anq. 1 and Cuq.; in hind wing to Anq. 3 in sc. (also in proximal half of length in c.), a little into ht. and t., and obliquely cut to halfway between apex of membranule and anal angle; margins of spot a little lighter. Membranule black. Pterostigma dull ochreous.

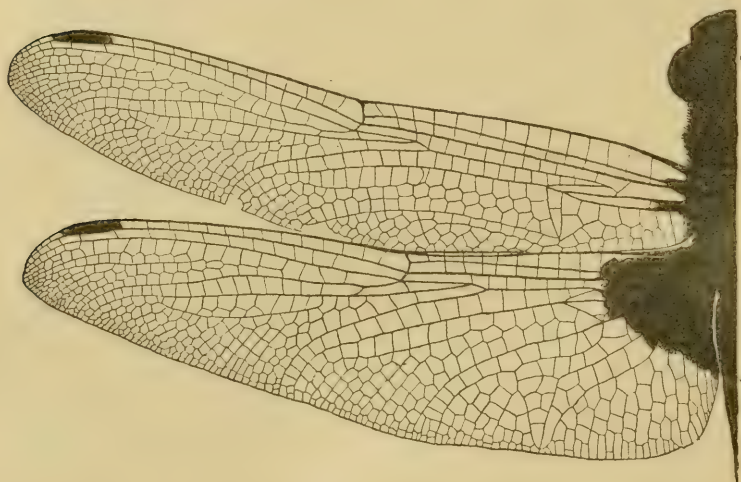
Anq. $\frac{13\frac{1}{2}}{11\frac{1}{2}} \cdot \frac{13\frac{1}{2}}{10\frac{1}{2}}$. Abd. 29, hw. 39, pt. 3.

♂ (subjuv., Mongheri).—Like first (type) specimen, but

dull olivaceous instead of blue (perhaps by posthumous decomposition). Anq. $\frac{13\frac{1}{2} \cdot 13\frac{1}{2}}{9\frac{1}{2} \cdot 9\frac{1}{2}}$.

♂ (subjuv., Oshogbo).—Light colour on frons and vertex pale bluish green, on thorax greyish green with a shade of violet, in interalar space greenish yellow, on abdomen dull and pale greyish violet. Anq. $\frac{14\frac{1}{2} \cdot 13\frac{3}{4}}{10 \cdot 10\frac{1}{2}}$.

♀ (subjuv., Oshogbo).—Sides of labium broadly olivaceous, anteclypeus dull olivaceous, postclypeus brown; head and thorax dorsally as in male, but light green, shading to olivaceous, on thoracic dorsum a diffuse brown dot on each side in green stripe; deep black from dorsal green stripe to a little more than halfway to humeral suture; rest of dorsum and sides wholly dark golden brown. Abdomen robust,



Wings of *Cyanothemis simpsoni*, Ris (type ♂), showing the discontinuity of the last antenodal in the hind wing. Photo. by F. W. Campion.

segments 2–3 a little widened dorso-ventrally, from middle of 4 to end almost parallel, little depressed; indistinct transverse carina on 4. Segments 1–2 dark brown, a rather broad, diffuse, mid-dorsal band of dull greenish yellow; 3 very light whitish violaceous, in front of transverse carina fuscous in lateral half; 4 the same pale colour at sides, obliquely cut; 5 fuscous; 6–8 dull golden brown, shading to olivaceous, carinae lined with black, narrowly on 6–7, broadly on 8; 9–10 black. Ventral surface fuscous. Margins of eighth segment folded, not widened. Vulvar scale erect, at

right angles, about half as long as ninth segment, elliptical in outline, laterally compressed; ninth ventral plate broadly projecting on tenth segment (not visible at base). Supra-anal tubercle large, black, densely covered with long black hairs; appendages small, acute, black.

Basal dark brown spot of wings slightly smaller than in male: vestige in front wing; in hind wing to Anq. 2 in sc., to arculus in costal half of m., halfway between Cuq. and t. in cu., to apex of membranule in anal area. Anq. $\frac{12\frac{1}{2}}{10\frac{1}{2}}$, $\frac{12\frac{1}{2}}{10\frac{1}{2}}$. Abd. 30, hw. 43, pt. <4.

This is one of the most remarkable Libellulinae seen by me. In venation the incomplete last antenodal in the hind wings is unique (absent in one of eight wings examined) in the subfamily. The colour-system is, perhaps, still more extraordinary: a very common pattern in Libellulinae, sky-blue and black, is obtained, not as in all other known cases by pruinosity, but by pigmentation, like the scarlet-red of so many other forms, or the blue and black of *Æschninae* and *Agrionidae*. In fact, *C. simpsoni* might be called a blue rendering of *Rhodothemis rufa*.

I have pleasure in naming this beautiful insect after the successful collector of Odonata in Sierra Leone, Dr. J. J. Simpson.

Pseudomacromia chrýsobaphes, sp. n.

Sierra Leone: 1 ♂, Sandea, 14. vi., 1 ♂, Jahama, 28. vi., 1 ♀, Sonkonía, 31. v. 1912 (*Dr. J. J. Simpson*) [the male from Jahama kindly given to the writer for his own collection].

Very large species. Group II. of table in Lib. In venation of discoidal and anal areas nearer *P. pretiosa*, in proportion of antenodal and postnodal part of wing nearer *P. eusebia*; differing from both by rich yellow markings on thorax and abdomen, and in this respect similar to *P. torrida*.

♂.—Labium in one specimen dull ochreous, median lobe obscure, in other specimen blackish, dull brown at free margins. Labrum black, narrowly lined with ferruginous at free margin. Face light olivaceous, a blackish curved line on anterior margin of postclypeus. Frons ochraceous at sides, dark metallic blue above, gradually passing into dull ferruginous at anterior margin. Vertex large, convex, entire, metallic blue. Thoracic dorsum brilliant metallic bluish black, markings very pale dull greenish, almost whitish: narrow antehumeral line, to two-thirds height, about halfway between median and humeral sutures; slightly broader complete line in front of humeral suture, continued in an equally

broad transverse band at antealar sinus. Sides light greenish yellow, with slightly diffuse brownish-black bands with greenish metallic reflections: (1) broad mesepimeral band, almost touching humeral suture and including a round pale spot at dorsal end; (2) narrower complete band across metastigma, with two processes, to dorsal and ventral third of second lateral suture; (3) narrow band on dorsal half of second lateral suture; (4) incomplete moderately broad band a little in front of middle of metepimeron. Ventral surface dull ochreous, sutures narrowly and diffusely brown. Legs dull and rather dark ferruginous. Third femora with about 18 teeth, the first six closely arranged, triangular, small, the following ones gradually increasing in size, more distant, quadrangular, directed towards base. Second femora with about 18 smaller teeth, similar in form, but directed distally. On third tibiae no spines externally, only a corresponding number of obtuse tubercles, internally the spines moderately robust, very short. Spines of second tibiae rather long and slender. Teeth of tarsal claws a little stronger than tips, variable in length, in same individual equal to tips, or slightly longer or shorter. Abdomen at base very little widened laterally, moderately so dorso-ventrally, very little constricted at third segment, afterwards almost parallel, rather robust. Black, with the following light yellow markings: segment 1, sides and a terminal ring; 2, sides, except a narrow terminal black ring and a very narrow black ring in front of transverse carina; 3, sides, a narrow complete basal ring, a very narrow transverse line at transverse carina, briefly interrupted in middle; narrow, incomplete mid-dorsal line; 4, slightly obscured basal ring, incomplete line at indistinct transverse carina, narrow mid-dorsal line; 5-6, very small spots at middle of lateral carina and indication of mid-dorsal line; 7, broad median transverse band of almost one-half the segment's length; 8-10 wholly black. Ventral surface 3-7 ochreous, with ends of each segment rather broadly and distinctly black; 8-10 black. Appendages black; superiors a little shorter than segment 9, convergent at base, slightly divergent in distal third, a little swollen towards the end and then terminating in a very fine and acute point; in side-view almost straight, inferior angle on distal third obtuse, a row of small, rather irregular denticles preceding it; inferior appendage but little shorter, slightly curved upwards, almost pointed. Genitalia of second segment: anterior lamina broad, erect, slightly emarginate, ciliate, yellowish, black at free margin. Hamule of about equal height, on subquadrate base; internal branch

a small hook, almost touching the anterior lamina, curved posteriorly; external branch merely indicated, being the obtuse posterior angle of basal piece. Lobe very small, narrowly oblong.

Wings stained with light greyish yellow throughout; minute golden-yellow vestige at base. Membranule fuscous. Pterostigma dark ferruginous. First specimen: Anq. $18\frac{1}{2}$. $19\frac{1}{2}$; Cuq. $\frac{1.1}{2.2}$; t. $\frac{1.1}{2.2}$; ti. 3 . 3; 3 rows in discoidal area of front wings; 1 row Rs.-Rspl., a few cells doubled in both front wings; 5 rows between A_3 and wing's edge. Abd. 41, hw. 53, pt. 4.5. Second specimen: Anq. $19\frac{1}{2}$. $19\frac{1}{2}$; Cuq. $\frac{1.2}{2.2}$; t. $\frac{1.1}{1.1}$; ti. 6 . 6; 1 row Rs.-Rspl.

♀.—Lighter in colour than male throughout; wings with a pattern of rich golden yellow and brown.—Labium ochreous. Labrum orange. Face light olivaceous. Frons brownish orange above, olivaceous at sides. Thoracic pattern as in male, but the dark portions lightened to ferruginous, without metallic reflections, and considerably reduced at sides. Legs light ferruginous. Third femora with very small triangular spinules; second femora with small, gradually lengthening spines; spines of third and second tibiae as in second tibiae of male. Teeth of tarsal claws as in male. Abdomen more widened at base than in male. Dull ferruginous instead of black throughout, pale markings similar, but lateral spots on segments 3-6 considerably larger. Appendages comparatively long, two-thirds of segment 9, very acute. Vulvar scale not clearly visible (covered by a mass of light yellow, relatively large eggs).

Wings light yellow, deep and rich golden yellow at base, in front wing to Anq. 2 and almost to arculus, in hind wing to Anq. 3, t., and a little beyond apex of membranule; lighter golden-yellow zone at nodus in costal half of front wing, over entire breadth in hind wing, and extended proximally to anal loop in anal half; tips golden brown to three cells width, proximally, from pterostigma. Membranule brown; pterostigma dark ferruginous. Anq. $16\frac{1}{2}$. $17\frac{1}{2}$; Cuq. $\frac{1.1}{2.2}$; t. $\frac{1.2}{1.1}$; ti. 4 . 4; 3 rows of discoidal cells, 4 cells once at t. in right wing; 1 row Rs.-Rspl.; 5 rows between A_3 and wing's edge. Abd. 43, hw. 53, pt. 4.5.

XVI.—*Description of a new Indian Scorpion* (*Charmus indicus*, sp. n.). By STANLEY HIRST.

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Charmus indicus, sp. n.

Granulation of *carapace* and *terga* very fine, but that of the fifth tergum is coarser. *Sterna* 1-4 finely punctured, the punctures on the fourth sternum being rather conspicuous, however; fifth sternum granular. *Tail*. A down composed of very fine short hairs is present on the tail, the segments of which are comparatively short and stout. First two segments granular, but the second has traces of punctures on its sides; with the exception of the inferior medians of the second segment, which are fairly distinct, the keels of these two anterior caudal segments are either absent or indistinct. Third segment densely punctured on the sides, but granular below and with the inferior median keels well developed and composed of fairly large granules (the granules between these keels are also rather coarse). Fourth and fifth segments without any trace of keels and furnished with very numerous, minute but deep, contiguous punctures; there are no granules on the sides or ventral surface of these segments. *Caudal vesicle* with numerous fine punctures. *Pectinal teeth* 17 in number. *Colour* dark brown; upper side of abdomen with a pale central linear marking, but it is very fine; caudal vesicle paler than the rest of the tail, being reddish brown in tint; palp dark brown, except for the fingers, which are yellow; legs variegated in much the same way as they are in *C. laneus*.

Measurements in mm.—Total length 14.75; length of carapace 1.8.

Locality.—Coimbatore (6. vi. 1912), a single example presented to the Museum by Mr. T. Bainbrigge Fletcher (Imperial Entomologist).

Remarks.—The unique specimen of this new scorpion is so small that I think it must be immature. It can, however, be easily distinguished from the only other member of the genus so far described (*Charmus laneus*, Karsch, from Ceylon) by a number of characters which seem to be of real value: for instance, the shortness and stoutness of the tail, the presence of punctures (instead of granules) on the sides of the third caudal segment, the much more numerous (contiguous) punctures of the last two caudal segments, and the

absence of granulation from the ventral surfaces of these two segments, &c.

Prof. Kraepelin states (Mt. Mus. Hamburg, xxx. p. 131, 1913) that he has examined a very young example of *C. laneus* from Coimbatore (Indian Museum Coll.). This specimen is the first one of the genus to be recorded from India, and obviously belongs to the same species as that which is described above as new, for it comes from the same locality. For the reasons already given, however, I think that it is not *C. laneus*, Karsch. With the exception of that sent by Mr. Bainbrigge Fletcher, there is only one specimen of the genus in the British Museum Collection, and, unfortunately, it is not known where it was collected. This specimen is the type of Pocock's *C. cinctipes*—a species now considered to be identical with *C. laneus*. If the specimens of *Charmus* from Coimbatore are really *C. laneus*, Pocock's species should be resuscitated, for it certainly does not belong to the same species.

XVII.—On Bats of the Genera *Nyctalus*, *Tylonycteris*, and *Pipistrellus*. By OLDFIELD THOMAS.

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Nyctalus joffrei, sp. n.

A small species, with short tragus and small *p*¹.

Size about as in *N. leisteri*, smaller than in *N. stenopterus*. General build suggesting a large *Pipistrel* rather than a *Noctule*, but the proportions of the digits quite as in *Nyctalus*. Ears short, broad, rounded, their substance unusually fleshy; inner margin convex, tip broadly rounded, outer margin convex, scarcely flattened above, antitragal lobule little developed. Tragus very short, expanded above, its inner margin concave, shorter than its greatest breadth above; outer margin convex, with the usual triangular basal lobe. Tip of fourth metacarpal reaching to the middle of the short first phalanx of the fifth finger. Wings to the ankle just beyond opposite the base of the calcar. Tail-tip projecting. Penis without bone, its prepuce thinly haired, separated into two cushions by a Y-shaped groove.

Colour uniform pale brown above and below.

Skull of a somewhat different shape from that of other species of the genus. The muzzle shorter, broader, with

more strongly developed supraorbital processes. Brain-case more inflated, smoothly rounded; sagittal crest low, not continued back to meet the lambdoid.

Inner incisors shorter than usual, broad, flattened, bilobate; outer small, about half the height of the inner. Canine with a strongly marked secondary cusp halfway up its hinder edge. P^1 minute, about a quarter of the area in cross-section of the small i^2 ; very low, invisible externally, hidden in the angle between the neighbouring teeth. Lower premolars very small, subequal, the tip of the posterior directly behind that of the anterior.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 39 mm.

Head and body 56; tail 39; ear (inner edge) 8; tragus (inner edge) 2; third finger, metacarpal 35.5, first phalanx 14; fifth finger, metacarpal 33, first phalanx 6.5; tibia 15; hind foot 8.

Skull: greatest length 15; condyle to foot of canine 14.2; basi-sinual length 11.4; zygomatic breadth 10.5; breadth on supraorbital processes 7.2; postorbital constriction 4.5; brain-case breadth 8.2; palato-sinual length 5; front of canine to back of m^3 5.1; front of p^4 to back of m^2 3.5; lower tooth-row (exclusive of incisors) 5.5.

Hab. Kachin Hills, Upper Burma.

Type. Adult male. B.M. no. 88.12.1.37. Collected by L. Fea and presented by the Marquis G. Doria.

This fine bat I had formerly supposed to be referable to *Pipistrellus affinis*, Dobs., of which the only recorded specimen is in Calcutta; but Dobson's measurements of the digits show that that is really a *Pipistrellus*, not a *Nyctalus*.

The known species of *Nyctalus* differ, *inter se*, by hardly any characters but size, so that the distinctions in tragus, skull, and dentition above detailed indicate that the present bat is more distinct from any of them than they are from each other.

The species is named in honour of General Joffre, Commander-in-Chief of the French Army.

TYLONYCTERIS.

While the forearms of the members of the genus *Tylonycteris* are all very nearly of the same length (26–29 mm.), the skulls show a considerable diversity in size, and it is quite evident that several different species or subspecies should be recognized. Moreover, the forearms do not vary in

proportion with the skulls, as specimens with the largest skulls have only the same forearm-length as examples with quite small skulls; the forearms are therefore of practically very little use in distinguishing the different forms.

Working then from the skulls, we find that there are three sizes represented in the series—large, middle, and small,—any one size being, as a rule, alone in a given country; but Java, the type-locality of *T. pachypus*, has both large and middle in it, and it is therefore necessary to settle which of these two is the type-form.

The Museum collection contains a considerable series from Buitenzorg and Tasikmalaja of the middle species, and from Sockaboemi of the large one. In addition, there is a co-typical example of *T. pachypus* acquired from the agent of the Leyden Museum in 1844, and this specimen clearly belongs to the smaller Javanese form, the one we have from Buitenzorg, near the type-locality of *pachypus*, Bantam. I therefore propose to assign the name *pachypus* to this form, the middle in size of the whole series, which has a skull about 11·7–12·0 mm. in greatest length, its maxillary tooth-row (front of canine to back of m^3) 3·8 to 4·0 mm.

In the Philippines (Luzon) we have the smallest form (skull 10·2 mm., tooth-row 3·4), representing *T. meyeri*, Peters, but a similarly small form occurs in Burma, and it should probably bear the name of *T. rubidus*, Blyth, described from Schwe Gyen. It is commonly deep rufous in colour.

Northwards and eastwards from Java occurs the largest species, while in Western India there is a middle-sized form of a peculiar colour, and these two appear to need new names.

Tylonycteris robustula, sp. n.

Body stout and robust, though the forearms are not only not longer, but are even commonly shorter, than in *T. pachypus*. Ears thick and fleshy; tragus short and comparatively broad.

Colour above dark brown; little lighter below. Membranes black.

Skull heavily built, very broad, both across the brain-case and interorbital constriction. Muzzle proportionally short.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 26 mm. (range up to 28).

Head and body 43; tail 27·5; ear 10; tragus 2·2 × 1·5; third finger, metacarpus 26, first phalanx 10; fifth finger, metacarpus 23·5, first phalanx 4·7; tibia 10; hind foot 6·3; breadth of foot-pad 3·5.

Skull: greatest length 12·5; median length 10·2; condyle to front of canine 11·7; interorbital constriction 4·1; breadth of brain-case 7·6; palato-sinual length 4·2; front of canine to back of m^3 4·2 (range up to 4·4); front of p^4 to back of m^2 2·7.

Hab. Malay Peninsula, Borneo, Java, Celebes, Timor. Type from Upper Sarawak, Borneo.

Type. Adult female. B.M. no. 11. 1. 18. 8. Collected and presented by Cecil J. Brooks, Esq.

Tylonycteris aurea, sp. n.

Size and proportions, including general body-bulk, length of forearms, and size of skull, about as in true *T. pachypus*. Ears perhaps rather narrower; tragus rather longer and narrower, its basal lobule with a longer and more acute point.

Colour above yellowish or dull gold, more or less overlaid with brown. Under surface yellowish or buffy. Limbs brown, membranes black, the cushions of wrists and sole also brown, not contrasted white as in *T. pachypus*. It is not certain, however, how far this may depend on methods of preservation.

Dimensions of the type (the italicized measurements taken in the flesh):—

Forearm 29 mm.

Head and body 42; *tail* 32; *ear* 9.

[A spirit-specimen measures:—Head and body 41; tail 30; ear 9; tragus 2·4 × 1·4; tibia 12·5; hind foot 6; breadth of sole-pad 3·8.]

Skull: greatest length 11·6, median length 10·1; condyle to front of canine 11·2; interorbital constriction 3·2; breadth of brain-case 6·7; palato-sinual length 4·4; front of canine to back of m^3 4; front of p^4 to back of m^2 2·6.

Hab. Southern Bombay—Kanara—southwards to Coorg. Type from Astoli, Belgaum. Alt. 2000'.

Type. Adult female. B.M. no. 0. 4. 2. 25. Original number 135. Collected 28th December, 1899, and presented by R. C. Wroughton. Fifteen specimens examined.

“In heavy forest.”—*R. C. W.*

I provisionally use a binomial for this bat, as it is geographically so isolated; but it may hereafter be shown to grade either into the Burmese form (*rubida*) or true *pachypus* of Java.

Pipistrellus imbricatus and its Allies.

So far as the Museum material shows, Java contains three small species of *Pipistrellus*—*P. tralatitius*, *P. imbricatus*, and a species allied to or identical with *P. papuanus*. Putting aside the last-named, we find that *P. imbricatus* differs from the common *P. tralatitius*, not only by its larger ears and broader tragus, but, in the skull, by the peculiar shortening of its muzzle, the definite development of basial pits, the extreme smallness of p^1 , which is only about one-fourth the area of i^2 , and by the fact that the posterior leg of the **Z** on m^3 projects further inwards compared to the anterior one than it does in *tralatitius*.

A series of *P. imbricatus* from Java are all just of the same size, and agree closely with the type (B.M. no. 79. 11. 21. 108*); and two specimens from Kangean, to the east of Madura, may also be assigned to the same form. But a large series from Central Borneo are uniformly much larger, and should evidently be distinguished specifically. These two both have fairly dark wings, while, on the other hand, the representative forms from Sumatra, Billiton, and Engano have whitish or white wings; but I have no specimens available, and cannot say if they have other distinguishing marks. For these the name of *macrotis*, Temm., is available, and I doubt if either *vordermanni*, Jent., from Billiton, or *curtatus*, Miller, from Engano, are really distinct. It may be noted that Mr. Miller first called his Engano specimens *imbricatus*, and then, in describing them as new, distinguished them from *imbricatus* by the exact characters that separate *imbricatus* itself from *tralatitius*—from which it seems probable that whatever specimens of "*imbricatus*" he compared them with were really examples of *tralatitius*.

Pipistrellus kitcheneri, sp. n.

Like *P. imbricatus*, but considerably larger.

Colour of fur a darker and richer brown than in *imbricatus*; under surface rather lighter. Wings smoky greyish,

* On p. 380 of P. Z. S. 1909, B.M. no. 79. 11. 21. 124 was mentioned as the type of *P. tralatitius*, Horsf.; but further examination shows that that specimen, although in the India Museum under the name of *tralatitius*, is really an example of *imbricatus*, while the other one mentioned, the "Lowo-manir," w^1 of Dobson's British Museum Catalogue, was received from Horsfield at an early date as *tralatitius*, and should therefore stand as the type. Its number is 62 *a*.

becoming lighter on the part external to the elbow, the reticulations prominent.

Skull essentially as in *imbricatus*, but considerably larger, and in the usual correlation with increased size, the ridges are rather better developed and the muzzle is less conspicuously shortened as compared with the brain-case.

Teeth quite as in *imbricatus*.

Dimensions of type (the italicized measurements taken in flesh) :—

Forearm 37 mm.

Head and body 56 mm.; tail 41; ear 14.

Skull: greatest length 14; median upper length 11.7; condyle to front of canine 13.6; basi-sinual length 11; constriction 3.7; breadth of brain-case 7; palato-sinual length 5.6; front of canine to back of m^3 4.8; front of p^4 to back of m^2 3.3.

Hab. South Central Borneo. Type from Boentok, Barito River. Alt. 20'.

Type. Adult female. B.M. no. 10.4.5.55. Original number 2101. Collected 1st October, 1909, by G. C. Shortridge. Presented by Oldfield Thomas. Fifteen specimens, all females with one exception.

Readily distinguishable from *P. imbricatus* by its superior size.

Named in honour of Field-Marshal Lord Kitchener of Khartoum.

Pipistrellus sturdeeii, sp. n.

A small species, with narrow delicate skull.

Size small; general build slender. Ears rather shorter and rounder than those of the Japanese *P. abramus*, inner margin rounded at base, but not prominently convex; tip broadly rounded off; outer margin flattened above, slightly convex below, with a well-marked anti-tragal lobule. Tragus of the general type of that of *abramus*, but shorter, its broadest point opposite the lower third of its inner margin; breadth going about $1\frac{2}{3}$ in the length of the inner margin, the latter straight; tip rounded, outer margin evenly convex, basal lobe sharply triangular. Wings to the base of the toes. A narrow postcalcarial lobule. Tail of the usual seven vertebrae, its extreme tip only projecting.

Colour of fur blackish throughout; the wings dark brown, without marked marginal lines.

Skull not much shorter than that of *P. abramus*, but markedly narrower throughout. Muzzle and brain-case smooth, rounded, the ridges little developed. Anterior

palatal incision not broadened, its posterior edge level with the middle of the canine. Posterior palate rather narrow, with an average median point. Basial pits indicated by slight lateral concavities opposite the basilar suture.

Teeth as in *P. abramus*, but smaller.

Incisors short, the anterior prominently bicuspid; outer incisor surpassing the second cusp of the inner one. Large premolar well separated from the canine, the space not filled up by the well-developed anterior premolar, which equals c^1 in area, and stands a little internally. Lower anterior premolar three-fourths the height of the posterior, and rather less than half its area in cross-section.

Dimensions of the type (slightly immature):—

Forearm 30 mm.

Head and body 37; tail 31; ear on inner edge 7·7; tragus (inner edge) 3, breadth 1·7; third finger, metacarpus 27, first phalanx 10; fifth finger, metacarpus 26, first phalanx 7·8; tibia 11; foot (c. u.) 6.

Skull: greatest length 12·1; basi-sinual length 8·7; condyle to front of canines 10·7; interorbital breadth 3·1; breadth of brain-case 6; mastoid breadth 6·4; palato-sinual length 4·3; breadth between outer corners of m^2 4·6; front of canine to back of m^3 4·2; front of p^4 to back of m^2 2·6; lower tooth-series exclusive of incisors 4·3.

Hab. Bonin Islands. Type from Hillsborough Island.

Typo. Female in spirit, slightly immature. B.M. no. 91. 2. 2. 3. Presented by H. Seebohm, Esq. Collected by P. A. Holst.

This *Pipistrel*, from the isolated Bonin group, is distinguishable by its narrow skull, as indicated by the measurements above, and the wide space between its canine and p^4 . It is presumably most nearly allied to the Japanese *P. abramus*.

Named in honour of Admiral Sir F. C. D. Sturdee, R.N.

Pipistrellus principulus, sp. n.

A small species with the short tooth-row of *P. tenuis* and *mimus*, but the skull much more inflated.

Size very small, about as in *P. tenuis* and *mimus*. General external characters as in those species. Ears of normal size, their substance thin; tragus of medium length and breadth, the external basal lobe large and sharply pointed. Wings to the base of the toes. Post-calcarial lobe distinct. Tail with seven vertebræ, its tip projecting.

Colour blackish, but as the specimen is in spirit, the exact

shade cannot be determined. Membranes dark, the hinder edge of the plagiopatagium and interfemoral with an inconspicuous light line.

Skull with a quite unusually swollen brain-case, the interorbital region also very broad and rounded, so that the "waist" of the skull is less marked than usual.

Teeth about as in *P. minus*. Outer incisor just equal to the well-developed secondary cusp of the inner. P^1 about two-thirds the area of i^2 ; canine and p^4 nearly but not quite touching each other external to it.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 30 mm.

Head and body 39; tail 30; ear 9; tragus on inner edge 3, breadth 1.6; third finger, metacarpus 28.5, first phalanx 11; fifth finger, metacarpus 27.5, first phalanx 7.3; tibia 11.5; hind foot 5.7.

Skull: greatest length 11.3; median length 10; condyle to front of canine 10.2; zygomatic breadth 8; intertemporal breadth 3.8; breadth of brain-case 6.3; height of brain-case from basion 4.5; front of canine to back of m^3 3.8; front of p^4 to back of m^2 2.5.

Hab. Assam. Type from Gauhati.

Type. Adult female. B.M. no. 13.3.14.1. Collected by Mr. S. W. Kemp. Presented by the Indian Museum, Calcutta.

This species, which equals the common Indian pygmy bat, *P. minus*, in the reduced extent of its tooth-row, differs from that, as from its other allies, by its unusually inflated skull.

XVIII.—*Ants from North and South-West Australia (G. F. Hill, Rowland Turner) and Christmas Island, Straits Settlements.*—Part II. By W. C. CRAWLEY, B.A.

I. Subfam. *PONERINÆ*.

Myrmecia sanguinea, Sm.

Yallingup, S.W. Australia (Rowland Turner). ♂.

Euponera (Brachyponera) lutea, Mayr.

Yallingup.

No. 89. *Rhytidoponera* (s. str.) *flava*, sp. n.

♂.—L. 8 mm.

Mandibles large, triangular, the terminal border regularly dentate; finely striate. Anterior border of clypeus regularly curved; frontal area indistinct. Head longer than broad, eyes large, placed in the centre of the sides of head, of which they occupy three-quarters; ocelli large and prominent. Frontal carinae short, diverging behind; scape of 13-jointed antennae slightly shorter than the second joint of funiculus, first joint of latter as broad as long; from the second joint of funiculus, which is the longest, the joints gradually diminish in length until the terminal, which is slightly longer than the preceding one. Mesonotum high and arched, Mayrian furrows almost invisible; scutellum prominent, rather small, and wider in front; epinotum longer than broad, with convex sides, only slightly narrower behind than in front. Upper wings with two cubital closed and two discoidal cells. Pedicel long and narrow, somewhat cylindrical, only slightly higher behind; underneath in front is a long, very thin, vertical spine. Gaster a little more than twice as long as broad, first segment (or post-petiole) as long as the second, the constriction between them moderately pronounced. Tibiae of the two posterior pairs of legs with two spurs, the inner long and pectinate, very shortly so in the middle pair and longer in the posterior pair. Claws bifid.

Head and thorax coarsely rugose; on the declivous surface of epinotum the rugosities radiate from a central ridge; node of pedicel transversely striate. First segment of gaster finely striate longitudinally, the lateral striae curving inwards and encircling the base; second segment finely striate transversely, the striae having a tendency to curve upwards; the remaining segments transversely striate. In one specimen the node and gaster are shining, the striae on the former being more feeble, those on the first segment of gaster are only apparent at the sides and base, and on the second segment they are diagonal, the central ones almost longitudinal.

Pilosity sparse and scattered, yellow; scapes and tibiae with erect hairs.

Chestnut, head and mesonotum darker.

Darwin, N.T., 1. vi. 13 (*Hill*). 3 ♂♂.

As no ♀♀ were captured with these ♂♂, I have thought it best to describe them provisionally as a new species, and have placed them in the subgenus *Rhytidoponera* (s. str.), although in the length of the scape and second joint of funiculus they do not entirely accord with Emery's characters given in the 'Genera Insectorum.' The number of males known is, however, small.

III. Subfam. *MYRMICINÆ*.No. 31. *Pheidole platypus*, sp. n.

♀.—L. 6·5–7·5 mm.

Mandibles very thick, coarsely striate, terminal border irregularly dentate when not worn to an irregular edge, no prominent teeth at apex. Clypeus emarginate in front, coarsely striate; frontal area small, deep, triangular. Head much longer than broad, with subparallel sides, emargination at back deep, wide, and triangular. Frontal carinæ half as long as the scape, which only reaches one-third of the distance from its base to the occiput. Eyes placed at the commencement of the anterior quarter of sides of head. There is a deep impression from the emargination of the occiput to the vertex. Tarsi of first pair of legs broad and flat. Promesonotum very high and rounded, pronotal protuberances sharp, terminated by small teeth or spines. Basal and declivous surfaces of epinotum of equal length, the spines short and narrow, half as long as the basal surface. First node narrow at top, widely emarginate, second node wider than long, without lateral angles. Gaster (when not distended) small and oval.

Whole of upper side of head coarsely striate longitudinally, the striæ curve outwards round the occiput and return as much finer lines down the sides and under surface of the head. The striæ are coarsest on the occipital lobes, where they have a downward and outward diagonal direction. Pronotum with fine irregular longitudinal ridges, the lateral ones bow-shaped (in some examples the ridges starting from the neck all curve in one direction and are terminated at the lateral tooth), finely reticulate between the ridges. Mesonotum with curved transverse ridges, the convexity of the curves towards the posterior border; occasionally the central ridges have a circular tendency; there is a faint reticulation between the ridges. Epinotum finely reticulate and longitudinally striate, the striæ not descending below the interval between the spines; from the base of the latter coarse striæ diverge outwards and up the sides. Nodes of pedicel finely reticulate, the second with a few longitudinal striæ. First segment of gaster faintly reticulate and with irregular longitudinal sculpture.

There is a yellow pilosity over the whole body; scapes and tibiæ with abundant hairs.

Dark red-brown; mandibles almost black, gaster brown.

♂.—L. 2–2·5 mm.

Mandibles striate, with a few punctures near the terminal

border, which is dentate and terminated by two long teeth. Anterior border of clypeus widely and very feebly emarginate, almost straight; there is a ridge down its centre. Frontal area deep, rounded at top. Head somewhat longer than wide, with slightly convex sides; back widely emarginate. The scapes reach the occipital border or a fraction farther. Eyes prominent, slightly in front of the centre of sides. Pronotum high and regularly curved, broader in front; at the centre of each side is a tooth-like ridge. Basal surface of epinotum longer than declivous surface; spines much shorter than basal surface, about as long as the interval between them. First node narrow, straight across the top; second node oval, longer than broad.

Head coarsely striate longitudinally and finely reticulate. Thorax and pedicel finely reticulate; pronotum with a few longitudinal ridges; a few ridges joining the mesonotum to the epinotum. Front of first segment of gaster faintly reticulate.

Body with yellow hairs; erect hairs on scapes and tibiae.

Yellow to red-brown. In dark specimens the antennae, tarsi, and joints of legs paler.

Stapleton, N.T., 1. v. 13 (*Hill*).

No. 214. *Pheidole megacephala*, F.

♂. Batchelor, N.T., 20. ix. 13 (*Hill*).

Cosmopolitan species.

No. 32. *Pheidole variabilis*, Mayr., var. *redunca*, var. n.

♂.—L. 2.7 mm.

Clypeus emarginate in front, with a ridge down the centre. The ridges continuing the frontal carinae are two-thirds as long as the scapes, which reach beyond the half distance from their bases to the occiput. Eyes just within the anterior third of sides of head. The impression from the occipital emargination is continued to the vertex. Spines as long as the basal surface of epinotum and longer than the interval between them.

Whole of upper and under surfaces of head finely reticulate; in addition, the under surface of front of head, the cheeks, and the whole of the top of head longitudinally striate; the ridges on each side of the central impression curve round the lobes of the occiput and continue down the sides of the head, those farther from the central impression making a narrow

curve within the larger ones and returning parallel to their origin by the insertions of the antennæ.

♂. L. 1.7 mm.

Similar to the type.

Darwin, N.T., 5. vii. 13 (*Hill*). ♀.

Crematogaster australis, Mayr.

Yallingup (*Turner*). ♀.

IV. Subfam. *DOLICHODERINÆ*.

No. 18. *Tapinoma minutum*, Mayr.

Darwin, N.T., 5. vii. 13 (*Hill*). ♀.

Iridomyrmex conifer, Forel.

Yallingup (*Turner*). ♀.

V. Subfam. *CAMPONOTINÆ*.

Camponotus (Myrmosaga) chaldeus, sp. n.

♂ major.—L. 9–9.5 mm.

Mandibles 5-dentate, coarsely striated, with a few punctures. Clypeus shield-shaped, not carinate, with a small deep emargination at the anterior border. Frontal area in the form of a right-angled triangle. Head slightly longer than broad, the sides almost parallel for two-thirds of their length, then narrowing rapidly, posterior border feebly concave. Eyes placed at the commencement of the hinder third of sides of head. Pro-mesonotum forms a regular curve in profile, the pronotum broad, with slight shoulders. Basal surface of epinotum deeply concave longitudinally, in the form of a saddle, declivous surface abrupt, almost perpendicular, slightly shorter than the basal surface. Scale high, fairly thin, somewhat wider at the top, which is nearly straight.

Head, pro- and mesonota finely reticulate-punctate; head in addition, particularly on the clypeus and cheeks, with large irregular punctures. Epinotum and scale finely striated transversely. Gaster very finely reticulated.

Body with fairly plentiful, erect, yellowish-white hairs, more sparse on the thorax, occasionally two or three on the scapes, and a row underneath the tibiæ; both scapes and tibiæ slightly pubescent, also thorax and gaster.

Black; legs, declivous surface and sides of basal surface of epinotum, and a patch on the metasternum (and sometimes on the mesosternum) dull red. Gaster bronzed.

♂ minor.—L. 7 mm.

Emargination of clypeus wider and not so deep. The concave basal surface of epinotum longer in proportion. The epinotum is often entirely dull red, and there is a small red patch on the mesosternum. Head sometimes with a faint bronze reflection. Scale proportionately much thicker, and more rounded on the top. Gaster bronzed.

♀.—L. 11.5 mm.

Emargination of clypeus as in ♂ major. Head rather wider than thorax. Pronotum very slightly shouldered. Basal surface of epinotum straight, and only one-third as long as the declivous surface. Sculpture as in ♂ major, except that the basal surface of epinotum is more reticulate than striate.

Colour as in ♂ major, except that the red extends from the sides across the top of the basal surface of epinotum, and there is a red patch on the mesosternum. The top of the scale also is red.

Yallingup, S.W. Australia (*Rowland Turner*). ♂ ♀.

From the description of the ♂ minor it will be seen that this ant very closely resembles the *C. (Myrmosaga) dewitzii*, Forel, from the Congo, described in the Bull. Soc. Vaud. Sci. nat. 1886 (♂ minor).

No. 85. *Polyrhachis comata*, sp. n., group *guerini*.

♂.—L. 5 mm.

Mandibles shining, densely striate (more coarsely than in *guerini*), with 4 (? 5) teeth. Clypeus subcarinate, the anterior margin produced in a short lobe (shorter and broader than in *guerini*), with a concave border and five small teeth. Frontal carinæ short, wider apart than the distance from each to the sides of the head, fairly divergent, and reaching the anterior margin of the eyes. The latter are placed near the posterior border of head and are not very prominent. Head slightly longer than broad, broader behind than in front, slightly convex behind, sides convex. Pronotum broader in front, the sides rectilineal and bordered; the teeth at the anterior angles of medium length, about twice as long as their width at base. Pro-mesonotal suture distinct, meso-epinotal less so. Epinotum with two spines as long as the width between them; declivous longer than basal surface. Pedicel with long curved spines, like buffalo's horns, thick at base, encircling the first segment of gaster. The first segment of the latter more than twice as long as the rest of the gaster, the whole rounded, about as broad as long.

Head finely reticulate, the sculpture almost concealed by the pubescence; opaque (shining and striate in *guerini*). Scapes finely reticulate. Thorax and pedicel (except the apical half of all the spines) coarsely reticulate-rugose, shining between the reticulations. On the lower half of the back of pedicel, between the spines, the rugosities take a transverse direction. Legs finely reticulate. Gaster very finely reticulate-punctate, the sculpture almost hidden by the pubescence. Erect hairs on head yellowish, on pro- and epinotum darker, on gaster golden. Pubescence on head very thick, silver-grey. Of the thorax, the epinotum only is pubescent, similarly to the head. On the gaster the pubescence is pale golden, merging into grey underneath. The femora and tibiæ have a slight silvery pubescence.

Stapleton, N.T., 22. xii. 12 (*Hill*). ♂.

No. 12. *Polyrhachis delicata*, sp. n.

♂.—L. 5.5–6 mm.

Mandibles 5-dentate, shining, with minute piligerous points; finely striate at base. Clypeus carinate, produced anteriorly into a slight lobe with a straight edge and pointed angles. Frontal area distinct, in the form of an equilateral triangle. Frontal carinæ long, very slightly convergent behind (similar to *thrinax*). Head longer than broad, wider behind than in front, occipital border not so rounded as in *thrinax*; eyes prominent, placed in the posterior third of sides. Thorax fairly regularly curved to the spines, pronotum shouldered, with very small teeth at the angles. Promesonotal and meso-epinotal sutures distinct; mesonotum broader in front; the two surfaces of epinotum equal in length, the declivous surface convex; the epinotum with two straight narrow spines, two-thirds as long as the basal surface of epinotum; node of pedicel with a thick and fairly high scale, in the centre of which is a long straight spine slightly directed backwards; in advance of this spine on each side is a shorter sharp spine directed outwards. The central spine, which is acuminate, not notched as in *thrinax*, is nearly three times as long as the lateral spines. Gaster round, slightly longer than broad.

Whole of head, thorax, and pedicel densely and finely reticulate, clypeus very finely so; head more rugose between the frontal carinæ and eyes, pronotum more or less longitudinally so; declivous surface of epinotum shining, only faintly and superficially reticulate; gaster shining, very faintly and superficially reticulate.

Pilosity practically nil; a few erect hairs on the mandibles,

clypeus, and between the front carinæ; clypeus slightly pubescent; gaster with a fine pubescence.

Red-brown, head and gaster darkest.

Darwin, N.T., 16. iv. 13 (*Hill*). ♂.

CHRISTMAS ISLAND, STRAITS SETTLEMENT.

A few ants were collected in March 1914, and kindly submitted to me by my friend Mr. D. Ward Pinkney. They are as follows:—

Odontomachus hæmatoda, L., var. *breviceps*, var. n.

♂.—L. (including mandibles) 8.5 mm.

Length of mandibles 1.2 mm.; width of head 1.6 mm.; length of head 2.1 mm. Head much shorter, broader, and less emarginate behind than in the type. Occipital lobes much more rounded. Head widest at the eyes. Sculpture, pubescence, &c., as in the type.

Colour: dark chestnut, legs paler.

One ♂.

Triglyphothrix striatidens, Em., ♀.

Solenopsis geminata, F., var. *rufa*, Jerd., 4 ♂ ♀.

Prenolepis vividula, Nyl., ♀.

CORRIGENDA (Part I., 'Annals,' ser. 8, vol. xv., Jan. 1915).

P. 134, line 26, for *Eur.* read *Em.*

P. 136, line 22, for *Myrmosphyma* read *Myrmophyma*.

XIX.—*Report on the Annelida Polychæta collected in the North Sea and adjacent parts by the Scotch Fishery Board Vessel 'Goldseeker.'*—Part IV. Goniadidæ to Spionidæ. By JAMES W. PRYDE, M.A., Walker Trust Research Scholar, Gatty Marine Laboratory, St. Andrews, and now 2nd Lieut. in the "Black Watch."

THIS, the fourth part of the Report on the Annelida Polychæta collected in the North Sea and adjacent parts by the Scotch Fishery Board vessel 'Goldseeker,' includes the following ten families:—Goniadidæ, Glyceridæ, Ariciidæ, Opheliidæ, Scalibregmidæ, Sphærodoridæ, Chloræmidæ, Chaetopteridæ,

Cirratulidæ, and Spionidæ. Most of the families are represented by one genus and one species only; but in the Chloræmidæ two genera, viz. *Stylarioides* and *Brada*, occur. The numbers of each species vary very much, and only in two cases, viz. *Anmotrypane aulogaster* and *Stylarioides plumosa*, do they exceed twenty-two examples. These numbers, therefore, differ greatly from those published in Part III. of the Report*, where one species, viz. *Hyalinæcia tubicola*, was represented by 649 specimens and 755 tubes. No annelids were obtained in the tubes of the Chætopteridæ, notwithstanding that these are fairly numerous in this collection. The Spionidæ, a family renowned for its varieties and for the difficulties one encounters in distinguishing its many species, have only one representative, viz. *Scolecolepis vulgaris*, and the absence of the other forms may be accounted for by the fact that the members prefer a littoral to a deep-sea habitat. In some families, e. g. Cirratulidæ, there is only one small representative, and it is interesting to note the slight differences which exist between this solitary specimen and the adult form.

No lists of synonyms have been given, but they can be obtained from Prof. M'Intosh's 'Monograph' under the heads of the various species. As already stated, the specimens were those belonging to the collection handed over to Mr. W. Small, M.A., B.Sc., by Prof. D'Arcy Thompson. In conclusion, I have to thank Prof. W. C. M'Intosh for his kindness in assisting me when I was in difficulties, and in giving me, from his own collection, a typical series of slides of each group.

Family Goniadidæ.

Genus GONIADA, Audouin and Edwards.

Goniada maculata, CErsted, 1843.

Only one small specimen, scarcely half an inch long, is the representative of the genus and species. It was obtained at Station 41 B at a depth of 15 fathoms, and was dredged along with *Megalia assimilis*. This form has a very wide range, and has been found from littoral waters to a depth of 795 fathoms ('Porcupine' Expedition of 1870). It is prevalent in the shallow waters of the North Sea, and extends to North American and Canadian waters. No member of the genus was obtained by the 'Challenger,' but at Station 167 A in 10 fathoms the only representative of the family,

* *Vide* Ann. & Mag. Nat. Hist. ser. 8, vol. xiv. p. 289 (October 1914).

viz. *Eona trifida*, was dredged. Izuka, in his researches in the seas of Japan, found three species, but *Goniada maculata* did not occur. The reports of the German investigations of this family are not to hand, and so no comparisons &c. can be drawn.

The head is a long, bluntly rounded, conical process, with four short squat cirri, and consists of eight segments, which are very indistinct in this form. The body has, including the head, about eighty segments, and tapers more anteriorly than posteriorly, where it ends in two fairly long tapering cirri, which are pale and translucent. The colour appears to vary with the sex and with the season. This example is dusky brown throughout, but light touches occur at the bases of the feet and on the sides of the head. For a full description of fresh forms see 'Monograph of British Annelids,' vol. ii. part ii. pp. 464-6. The feet stand out conspicuously from the sides of the body, and are in agreement with those of typical forms. The bristles, however, like the example, are small, but are quite characteristic of the species, being pale in colour, tapering, and thin, the dorsal bristles having straight shafts, with no serrations or terminal pieces, and slightly dilatated tips. The ventral bristles are also pale and have fairly long curved shafts, with slender serrated terminal pieces articulated at the ends. The bristles are arranged fan-wise, and the tips of the posterior bristles, especially the central series of the fan, attain a much greater length.

The alimentary tract is simple, fairly narrow posteriorly, but wide anteriorly, and is easily seen through the thin body-wall. The mouth is ventral, possesses lips, and the anus lies between the two anal cirri already mentioned. The specimen is not mature, but some forms procured off the S.W. of Ireland had large ova in July. Prof. M'Intosh is inclined to think that *Goniada alcockiana*, Dr. Carrington, is a variety of this species.

Genus GLYCINDE, Fritz Müller.

Glycinde nordmanni, Malmgren, 1866.

Four very much dried and shrivelled specimens of this annelid were dredged on the 4th December, 1905, at Dabs Voe, in 15 fathoms. Each measures about 2 inches long, but one is very much thinner and more linear than the others, whose bodies taper anteriorly but more gradually posteriorly. The colour is dark brown, resembling that of *Ophiodromus flexuosus*, and there is little difference in hue

on dorsum and ventrum. This unique colour is no doubt due to the scorching the animals received in the laboratory fire, for in living examples the animals are pale pink or skin-coloured. The species is not uncommon in the stomach of the cod and flounder, and, when plentiful, forms abundant food-supply for these fishes. The range of the species is wide, for, besides being prevalent in British waters, it has been found off the Siberian coast (*Wirén*) and at other parts of the world. Allied forms, like those of the 'Challenger' collection, frequent shallow water. No mention of this species is made by Izuka, and no German report has come to notice.

The head is conical, but the four tentacles at the tip are just like little warts. No eyes are distinct, and the proboscis, although extended in three forms, has been injured and shows the various pieces of armature very poorly. The feet, although considerably dried, conform with the type-slides, and the bristles are quite characteristic of the species. None of the specimens were mature, but, according to various observers, the females at least become mature about June or July, and although no ripe males have been recorded, it is probable that both sexes mature simultaneously.

Prof. McIntosh says "It is remarkable to find such slight differences between the *Glycinde trifida* of the 'Challenger' from Charlotte Sound, New Zealand, and the British form."

Family Glyceridæ.

Genus GLYCERA, Savigny, 1820.

Glyceria lapidum, De Quatrefages, 1843.

In haul 111 one incomplete specimen of this form was dredged along with *Lumbriconereis gracilis* at a station $\frac{1}{4}$ mile N.W. of Gluss Island, Shetland, at a depth of 16 fathoms. The animal is about $1\frac{1}{4}$ inches long and has about sixty bristled segments, each segment being three-ringed, and all appearing equal. Although only one example appears in the collection, this species is by no means scarce or uncommon, as the habitat given in Prof. McIntosh's 'Monograph' will show. It is found in deep as well as in shallow water, abounds in British seas, and extends to Norway, shores of North America, west coast of North America, Azores, Setubal, Mediterranean, but is not recorded in 'Challenger' Report nor from Japan.

The head tapers to a blunt point, from which four short slender tentacles arise, while the body tapers more posteriorly

than anteriorly. The dorsum is more convex than the ventrum, but the convexity is lost in the caudal region, which is somewhat flat and strap-shaped and terminates in two anal cirri.

Anteriorly the body has a rich golden-brown colour, which gradually changes to yellowish white posteriorly. The body-wall is thin and transparent, and the simple straight gut with its contents shines through, thus reminding one of the condition prevalent in the posterior region of many of the Eunicidæ.

The proboscis is fairly long, being about one-third the length of the entire animal, and presents a hard and very muscular appearance. It is richly covered with minute papillæ, which, according to the Monograph*, are filiform, with crenated edges. The tip, which is much wider than the base, roughly forms a square, at whose corners is placed a black, spurred, powerful tooth. The teeth are sunk in bulb-like muscular pads, the opening of the proboscis being where the pads meet in the centre. The organ is pinkish in colour and has many minute transverse striæ.

The feet are slender and appear on the anterior ring of the segment, a condition reversed in *Eumenia jeffreysii*, where the feet are borne on the posterior ring. They are white in colour and semitransparent. The example is so small that the anterior feet could not be removed without incurring serious damage to the animal; however, a lengthy account of them can be had in the Monograph. The feet from the twentieth were found to be quite typical, although the bristles were much more slender than those of the type-series. The specimen was not mature, but in this species epitokous forms appear which have larger bodies, longer and more prominently marked feet, and more attenuate bristles. From observation the animals ripen and shed their sexual products in the month of July.

Family Ariciidæ.

Genus ARICIA, Savigny, 1820.

Aricia cuvieri, Audouin and Edwards, 1833.

The distribution of the above family is very uncertain, and several well-known European forms extend to the shores of North America, where they have received different names. The members of the family frequent deep or inshore waters.

* Vide 'Monograph,' vol. ii. part ii. p. 480.

In this collection six examples were obtained in a fry-net in haul 6820 at 152 m. on 6th February, 1907, at Station 39 B, lat. $57^{\circ} 59' N.$, long. $0^{\circ} 57' E.$ The animals are very small, the largest being about 2 inches long, but 6 to 8 inches is a common size. From accounts given by other writers the above species is a deep-water form, having been obtained at depths ranging from 164 to 422 fathoms, 'Porcupine' Expedition of 1869, and from 257 to 358 fathoms by the same Expedition of 1870. It extends to Norway and the shores of Greenland, but neither Izuka nor the writer of the 'Challenger' Report makes any mention of it.

The head is small and conical, and agrees with the description laid down in the Monograph*. The proboscis is unarmed.

The body of the largest has about 65 bristled segments. It is stout in comparison with its breadth and attains its maximum breadth about the anterior ninth or tenth, where it measures about 4 mm. From this part it tapers quickly anteriorly, but more gradually posteriorly till it ends bluntly, the anus being situated at the tip dorsally, with two lateral flaps, a ventral process and papilla, and with two very long slender cirri, which the writer of the Monograph notes pass off from the anterior part as in *Aricia latreillii*. The dorsum, except in the first five segments, is flat, while the ventrum is rounded. Gradually, however, a groove appears ventrally, deepens and becomes more prominent towards the caudal region, which is absent in several of the specimens. The peristomium is narrow dorsally, but broad ventrally, the mouth occupying the position of the median ventral line at the posterior border of the segment. In shape the mouth resembles a sunken pit with smooth rounded sides, having two prominent crescentic lips, which are lateral in position, but there are no longitudinal symmetrical furrows passing forward from the segments behind. The proboscis, which is not extruded in any, is a deeply frilled organ which projects from the mouth as a button-like process. The Monograph adds "There are about ten frills in the form of a rosette."

The feet commence at the second segment and continue to the anus, but in the first twenty or thirty segments the dorsal portion of each foot is different from the ventral. From the thirty-first, however, both portions are similar. The feet agree with the descriptions laid down in the Monograph and with the types on the slides, and in position on the body they are situated more dorsally than ventrally. However, towards

* *Vide* 'Monograph,' vol. ii. part ii. p. 499.

the caudal region the feet become lateral in position, but never ventro-lateral. The branchiæ commence at the fifth pair of feet, and appear as little conical processes which increase in size from before backward. They are nearer the mid-dorsal line than the dorsal cirri, but between the twentieth and thirtieth segments they leave this region and approach the cirri. This, however, I find to be variable. Along with the increase in size of the branchiæ there is a corresponding increase in the size of the dorsal cirri, and this increase is especially marked at the base of the organs. Each branchia has two vessels which are linked together by a numerous series of connecting-trunks. The bristles, spines, and papillæ of the feet all conform with the Monograph*. The segmental organs are limited, but appear more prominently in posterior two-thirds of the body. All the examples are immature. However, quoting from the Monograph†, "Lo Bianco found *Aricia fœtida*, Clap., ripe from January to June at Naples. The eggs are of a greenish colour and deposited in a cylindrical vermiform mass of mucus."

The contents of the gut were composed of fine mud particles, débris, and vegetable matter.

Family Opheliidæ.

Genus AMMOTRYPANE.

Ammotrypane aulogaster, H. Rathke.

Twenty-two specimens of this form, which has a general distribution, are present in the collection, but, like many others, they have suffered from the laboratory fire mentioned in previous reports. The tube containing the animals has no label, and consequently no depth nor locality can be given. The animals themselves are badly scorched and very much shrivelled. This species is found off the shores of the British Isles, but extends much farther north. Izuka makes no reference to either the family or the species, but in the 'Challenger' Report there is a form, *Ammotrypane gracile*, dredged off Japan, which closely resembles the European species.

The head is pointed, fairly large, but devoid of tentacles, tentacular cirri, and eyes. The mouth is ventral in position and appears as a fairly large longitudinal slit, which continues as a ventral groove to the posterior end of the animal.

The body is linear, the longest specimen measuring about

* *Vide* 'Monograph,' vol. ii. part ii. p. 500.

† *Ibid.* p. 501.

2 inches, being pinkish brown on the dorsum and pale pink on the ventrum and at extreme anterior end. The body-wall is smooth, firm, and thick, and agrees generally with that of *Ammotrypane gracile*, which, however, differs from it in having the intermediate pedicle—between the dorsal and ventral longitudinal muscles—short. The ventral groove, running from mouth to anus, is fairly deep, and is flanked by thick brood-ridges, which disappear at the scoop-shaped hood surrounding the anus. Along each border of the hood there are four cirri, while a pair of larger and thicker cirri, with a slender cirrus between them, are situated at the base.

The feet, with bristles and branchiæ, are placed laterally in close relation to the ventral ridges. In several they seem to occupy lateral shallow grooves formed by the ridges on the ventral side and by the convexity of the dorsum on the other. The bristles agree with the type-examples, but the branchiæ do not arise on the same foot in every form, this probably being due to the destruction of these organs by the fire.

In transverse section the cuticle is very dense, but the hypoderm is not strongly developed. The nerve-area, situated ventrally, appears as a transverse band, and so differs from that of *Ammotrypane gracile*, which is ovoid. The longitudinal dorsal muscles have regularly arranged fasciculi and slant obliquely along the dorsal arch from a kind of median raphe.

The specimens were immature, and the contents of the intestine were mud, sandy particles, and débris. In the intestine of a 'Challenger' specimen was sandy mud, with diatoms, broken sponge-spicules, fragments of Echinoderm spines, and Foraminifera.

Family Scalibregmidæ.

Genus EUMENIA.

Eumenia (Lipobranchus) jeffreysii, M'Intosh.

This species is the sole member of the above family in the collection, and it is surprising that *Scalibregma inflatum*, a form having a wide distribution, does not occur. The following table gives the data connected with the hauls:—

Date.	Haul.	Station.	Depth.	Apparatus.	Number obtained.
17-7-08	152	Ardmore Point 1½ miles S.	180 m.	Dredge.	14
28-6-09	192	Kinnaird Deep.	181 m.	Dredge.	6

No mention of this species is made by Izuka or the writer of the 'Challenger' Report, although the genus *Eumenia* has one representative among the 'Challenger' worms, viz. *Eumenia reticulata*, which differs from Théel's *Eumenia longisetosa* in that the dorsal lamellæ commence at the fifteenth instead of at the tenth foot. *Eumenia jeffreysii* extends to Norway, and Dr. Gwyn Jeffreys dredged it off the Hebrides and the Shetland Isles; but there is reason to believe that it abounds in more northern latitudes.

The head is bluntly conical in shape, contracted in appearance, and has a slight median groove, but bears no tentacles. The body is maggot-like, deep reddish brown in colour, which is often deeper in hue at the ends, and the feet are represented by dorsal and ventral pads, from which the bristles project. The bristles are long, linear, and translucent; while the spines which support the feet are stout and strong, although fairly short. There are no anal cirri, while those on the feet, if present, are rudimentary. Each segment has three rings, of which the posterior, bearing the feet, is the most pronounced. Each ring, moreover, is formed by an aggregation of small papillæ, which give the animal a rough, warty appearance.

Although the animal is short, the gut, when exposed, is fairly long, sacculated in appearance, and is of great width where the sacculations occur. The gut-wall is very thin, and the gut-contents can be easily seen as a yellowish-green mass which differs in appearance from the dark green-coloured faecal packets found in *Hyalinæcia tubicola* and other Eunicidæ. The mouth opens into a buccal cavity, which leads into a short but fairly wide œsophagus, which, in turn, enters a muscular stomach cubical in shape. From the posterior end of the stomach the gut extends to the anus, which is a prominent aperture at the tip of the tail. In several of the examples there was a large reddish-coloured mass surrounding the posterior region of the gut, yet often having extensions in the anterior end. This mass was composed of ova in some cases and in others of spermatozoa, which were aggregated together to form spermatophores, which were almost as large as the ova, but which did not possess zonæ. In the anterior region the gut is moored in position by five or six mesenteries, which are very thin and which stretch from the wall of the gut to the body-wall. There may also be one or two at the posterior end. A rich supply of blood-vessels and nerves extends along the whole alimentary canal.

The nervous system of this species is very well developed. There is a fairly large bilobed brain, which gives off a ventral

nerve-cord. On this cord there are small ganglia which are situated in the same part of each segment as the feet and from which branches are sent out to the feet and the gut.

Family *Sphærodoridæ*.

Genus *EPHESIA*, H. Rathke.

Ephesia gracilis.

One incomplete specimen having seventy-eight segments was dredged along with *Syllis cornuta* in 15 fathoms. The example is almost complete, only a few of the posterior segments being absent. It is linear in outline, tapered anteriorly and posteriorly, and attaining its maximum breadth about the thirty-second segment.

The head is fairly large, almost quadrangular in shape, and at the anterior corners of the quadrangle there are bulb-like palpi which have nipple-like apices. The cirri in the anterior region are very indistinct, having been damaged in the mounting of the example. The anterior segments are short, fairly narrow, and appear to be somewhat crowded; but in the posterior region of the animal the segments are so broad that the intervals between consecutive feet are conspicuous. The colour is brown and the body-wall is so thin and transparent that the entire gut is seen as a simple tube which is narrow anteriorly, very wide in the mid-region, and fairly wide posteriorly. All over the body, both dorsally and ventrally, occur numerous transverse striæ, which are only visible under very high power. The animal is not mature.

The *Sphærodoridæ* do not occur in Grube's 'Gazelle' collection nor in that from the Philippines. Schmarda gives a single doubtful form from Jamaica. In the 'Porcupine' Expedition this species was obtained at a depth of 664 fathoms, and in the Norske Nordhavs-Expedition it occurred at 417 fathoms. No mention of the species is made in the 'Challenger' Report, but an interesting form, *Ephesia antarctica*, was procured at Station 156 near the antarctic circle at a depth of 1975 fathoms*.

"The segments resemble those of the common *Ephesia gracilis*. Dorsally is the large globular appendage, which exhibits a much more minute papilla than in the latter form.

* Vide 'Challenger' Report, vol. xii. p. 361.

Internally the globular processes have elongated granular structures. The skin of the foot is likewise covered with papillæ. A single spine supports the foot, the bristles in which differ from those of the adult *Ephesia gracilis* in having the terminal piece less hooked as well as distinctly differentiated from the end of the shaft. The terminal piece forms a somewhat conical process with an oblique base, the dorsal margin being slightly convex, the ventral slightly concave. The shaft is somewhat curved and is dilated at the tip below the bevelled articular surface. The bristles are very translucent and approach those of *Ephesia canadensis*, a species, however, which differs in other respects from this form."

Family Chloræmidæ.

Genus STYLARIOIDES.

Stylarioides plumosa, O. F. Müller.

This species is one of the two representatives of a somewhat widely distributed and noteworthy family. The annelids were obtained as follows :—

Date.	Haul.	Station.	Locality.	Depth.	Apparatus.	Number obtained.
8-7-07	89	16	62° N., 6° 12' W.	128 m.	Sm. Trawl.	21+fragments.
28-6-09	19		Kinnaird Deep.	181 m.	Dredge.	4.

In "Notes from the Gatty Marine Laboratory, St. Andrews. —No. XXX."*, Prof. M'Intosh gives the above as a common British species; but it is generally distributed in the North European seas, and extends to Greenland and the shores of America. This species, however, does not appear in the dredgings of the 'Porcupine' Expeditions of 1869 and 1870, although the genus is well represented by *Stylarioides glauca*, *S. flabellata*, and *S. sarsii*, which resembles *S. plumosa*, but has a shorter anterior region, fewer segments, more velvety surface, and stiffer dorsal bristles. In the dredgings of Dr. Whiteaves in the Gulf of St. Lawrence, Canada, good

* Vide Ann. & Mag. Nat. Hist. ser. 8, vol. ii. p. 524 (Dec. 1908).

examples of *S. plumosa* were obtained. Again, Canon Norman found several of this species, but his examples are much inferior to those from British waters. Perhaps it may be said that the home of the genus is in North European seas and in the Arctic Ocean, for in Northern Norwegian waters alone the following species abound :—*Stylarioides plumosa*, *S. glauca*, *S. flabellata*, *S. hirsuta*, and *S. normani*.

In the 'Challenger' Report* the writer notes : "The distribution of this family [Chlorœmidæ] is in some respects noteworthy, both as regards area and depth. Thus most of the specimens described by former voyagers come from shallow water or between tide-marks, but the explorations of the 'Challenger' have carried these peculiar forms to a depth of 2500 fathoms, or nearly twice the depth at which the naturalists on board the 'Porcupine' had found *Stylarioides glauca*. Moreover, the wide distribution of the remarkable intermediate type, *Buskiella abyssorum*, is interesting in connection with the view that the ancient forms have been gradually driven into the great depths by the more recent types attaining supremacy in the shallower water." Three new species were added to the list by this ('Challenger') Expedition.

The specimens of this collection are not very large, the longest being about 2 inches and having fifty segments and the shortest a little over one-quarter of an inch with twenty-four segments. They agree with the description given in Ann. & Mag. Nat. Hist. ser. 8, vol. ii. (December 1908), but the hoof-shaped process does not occur in any. The bristles of the small, probably a young, form are not of the usually golden colour, but are semitransparent, very slender, and taper to fine points. The transverse markings, however, are quite distinct and characteristic. The surface of the body is very rugose and the bristles of the feet project from it in little clumps. These bristles, like those of the anterior region, are pale, non-iridescent, and translucent.

The branchiæ are shrivelled and pale, but in life they are beautiful green-coloured organs, the coloration being due to the blood, which is green, and are protected, like the palpi, by the anterior bristles, which have a forward and upward direction.

Prof. Mcintosh remarks :—"It is interesting that the type of bristle seen in this form persists in species from the Indian and other oceans, as shown, amongst others, by Prof. Ehlers

* Vide 'Challenger' Report, vol. xii. p. 362.

in his recent beautiful work on the annelids of the German Deep-sea Expedition."

Genus BRADA, Stimpson.

Brada normani.

Three examples of this annelid were found on 8/7/07 in haul 87 at Station 16, lat. 62° N., long. $6^{\circ} 12'$ W., in a small trawl at the depth of 128 m. Each animal measures a little over an inch, and has twenty-two segments. There is a test of very fine sand-grains surrounding the body, and, like the surface of the body, is very rugose. The bristles in the anterior region and on the setigerous processes project as little golden clumps beyond the sandy test.

The body is maggot-like, having the anterior end more bluntly rounded than the posterior. The mouth is a conspicuous triradiate opening at the extreme anterior end, while the anus appears as a vertical slit at the extreme posterior. The lips are thick, swollen, and covered with minute sand-particles. Along the line of the dorsal bristles there are large, long, flattened papillæ which have pointed tips. As Prof. McIntosh remarks, "These papillæ differ in a marked degree from those usually seen in *Stylarioides*, *Brada villosa* or *granulata*. The dorsal bristles are few, slender, and inconspicuous. The ventral ones are long, have thick shafts of almost uniform breadth throughout, and end in bluntly rounded tips which are slightly bent. The tips in some, however, are probe-like and tend to be slightly attenuate. These bristles have well-marked transverse striæ, which become fainter towards the tips, where they ultimately disappear. In many there are also oblique striæ which are prominent on the part of the bristle projecting beyond the surface. The setigerous lobes are fairly conspicuous, standing out from the rugose surface as little elevations from which the bristles project, and around which are clustered several bulbous papillæ. The gut is simple, straight, and very narrow, and in segments 6, 7, and 8 it is surrounded by a dense mass of ova which are reddish-yellow in colour. The ova are small, spherical, and have very thick zonæ.

Family Chætopteridæ.

Genus PHYLLOCHÆTOPTERUS, Grube.

No species can be assigned to the various tubes of this genus, which were procured as follows:—

Date.	Haul.	Station.	Locality.	Depth.	Apparatus.	Number obtained.
21-6-06	31	Buchan Deep.	57° 31' N., 1° 12' E.	106 m.	Sm. Trawl.	3 tubes.
27-7-06	45	23 A	59° 51' N., 1° 12' E.	115 m.	Sm. Trawl.	1 tube.
20-7-07	103	.....	Kinnaird Deep.	201 m.	Dredge.	5 tubes.
20-7-07	103	.....	Kinnaird Head.	20 fms.	Fry Net.	2 tubes.
14-2-08	8730	40 B	57° 24' N., 1° 7' E.	95 m.	Dredge.	3 tubes.
7-7-08	142	Knoere Knap-Sagna Fiord N.E./N. $\frac{1}{2}$ mile.		395 m.	Dredge.	3 tubes.
			No label.			10 tubes.
			No label.			3 tubes.

The tubes differ very much in size and thickness, and while some have rings clear, well marked, and at regular intervals, others have them irregularly placed and almost indistinct. The tubes found at Buchan Deep are about 8 inches long, fairly thin, clear, and nearly transparent, and are almost entirely filled with very fine sand. They have irregularly arranged transverse striations, and at one end there is often a perforated septum, which probably acts as a means of defence and at the same time functioning as the V-shaped or zigzag valves in *Hyalinæcia tubicola*. Prof. M'Intosh, in his remarks on this genus in the 'Challenger' collection, says:—"Toward the posterior end a very neat diaphragm with a minute aperture in the centre occurs; and above the septum is occasionally a collection of the small ovoid fæcal masses and other débris, so that this region of the tube is rendered opaque"*. The rings on the tubes were very irregular and only a few were well pronounced. The tube obtained at Station 23 A was fragmentary and resembled the quill-like tube of *Hyalinæcia tubicola*, but no valves or septum was present. Those dredged at Kinnaird Head and Deep were taken along with several Polynoidæ, Serpulidæ, and Terebellidæ, and, although quill-like, they were brown in colour and very much coarser than that previously mentioned. One measured about 8 inches long and was annulated at short but fairly regular intervals, and every tenth or fifteenth ring was stronger and better made than the others. Another had a very marked septum at one end. One of

* Vide 'Challenger' Report, vol. xii. p. 376, pl. xlv. 10 a.

three taken at Station 40 B had an external coating composed of broken pieces of Hydroids—mostly *Obelia* and *Sertularia*—small pecten-valves, coarse sand, and pieces of gravel. Those obtained in Sagna Fiord were quill-like, and were taken along with Nephthydidæ, Eunicidæ, and Maldanidæ.

Sometimes tubes are obtained showing forked branching, an appearance which is due to a fracture of the tube, and the continuation of the latter, not by the union of the broken ends, but by the secretion of a new piece with which the tunnel is continuous. The broken fragment has its channel closed, and it remains adherent apparently as a useless process. Prof. M'Intosh says, "this occurs both anteriorly and posteriorly, as tubes are found with a diaphragm in each limb of the fork. The bifurcation is thus only apparent, not actual" *.

This genus is represented in the 'Challenger' collection by a new species called *Phyllochætoperus claparedii*.

Genus SPIOCHÆTOPTERUS, Sars.

Several tubes belonging to this genus were found in the following hauls:—

Date.	Haul.	Station.	Locality.	Depth.	Apparatus.	Number obtained.
4-9-06	61	7	61° 06' N., 2° 1' E.	134 m.	Sm. Trawl.	4 tubes.
14-2-08	8730	40 B	57° 24' N., 1° 7' E.	95 m.	Fry Net.	2 tubes.
9-6-08	201	16	62° N., 6° 12' W.	112 m.	Dredge.	1 tube.
			No label.			1 tube.
			No label.			1 tube.

The tubes are all sizes and some are coated with fragments of small shells, valves of minute pectens, coarse sand, and gravel. Some, however, have a thick paper-like constituency and are very wide in bore. If the fragments of shells etc. be picked off or dissolved away, the internal portion of the tubes is yellowish and hyaline in character; but in the paper-like tubes no trace of the hyaline character is visible. None of the tubes show the valvular condition.

In the 'Challenger' Expedition several yellowish hyaline

* Vide 'Challenger' Report, vol. xii. p. 376.

tubes were obtained off the coast of New York at the depth of 1240 fathoms*, but, like those of the present collection, they were empty.

Family Cirratulidæ.

Genus CHÆTOZONE, Malmgren.

Chætozone norvegica.

At Station 41 B, lat. $56^{\circ} 42' N.$, long. $0^{\circ} 35' E.$, and at a depth of 75 m., a small complete form about a quarter of an inch in length was dredged. The feet, bristles, and general body-characters are quite diagnostic of the species, and there is nothing of outstanding interest about the form. The bristles are very slender, finely tapered, and almost transparent. The animal is not mature.

This genus is usually found in deep water, while the genus *Cirratulus* frequents shallower depths. In the 'Challenger' Report one member of the genus *Chætozone*, viz. *Chætozone benthaliana*, was found as deep as 1250 fathoms, while other representatives were procured at depths varying from 400 to 700 fathoms. The species *Chætozone setosa* described by Malmgren was found at a depth of 20–40 orgyiar.

Family Spionidæ.

Genus SCOLECOLEPIS.

Scolecolepis vulgaris, Johnston.

This species is the only representative of the Spionidæ. The members of the family are found in greater number in shallow water than in deep water, and in this present collection there are two fragments, each about 1 inch long, showing neither head nor tail. The fragments were obtained in haul 174 with a small trawl on 24th August, 1908, at Station 19 A, lat. $60^{\circ} 36' N.$, long. $4^{\circ} 46' W.$, and at a depth of 1030 m. This depth is the greatest which has as yet occurred in the data of the hauls connected with the Scotch North Sea investigations; but in the 'Challenger' Report members of the family were dredged at depths ranging from 110–725 fathoms. In the account of this species given by M'Intosh† no depth is given, and in Izuka's work on the Errantiate Polychæta of Japan the Spionidæ do not even occur.

* *Vide* 'Challenger' Report, vol. xii. p. 380.

† *Vide* Ann. & Mag. Nat. Hist. ser. 8, vol. iii. p. 153 (Feb. 1909).

The fragments are very much lacerated, but the feet, which are close together, are not damaged, and agree with those on the type-slides. One of the fragments contains feet which must come before the fiftieth foot, because the ventral division shows no long winged hooks, which only appear about the fiftieth. However, there is some uncertainty where the hooks commence, for according to De St. Joseph they appear between the thirtieth and the fifty-second, while another investigator, Mesnil, records their appearance from the thirty-fifth to the thirty-seventh. The hooks are very powerful, having strong stout shafts which are curved and prominently striated, the hooks themselves facing upwards. The wings are large and extend to the surface of the lamella. Accompanying the hooks are slender, finely pointed, smooth bristles whose tips reach upwards beyond the hooks, while ventrally beyond the last hook there is a cluster of six or seven—three, according to Prof. M'Intosh,—which are minutely striated. In all the slender bristles the tips are curved and face downwards. The dorsal bristles are long, slender, and finely pointed, the length extending beyond the lamella being only about one-fourth the total length. The bristles arise close together and spread out fan-wise as they extend outwards. The bases are sheathed in muscles, which move them. The branchiæ which are present on all the feet of the fragments are large, bluntly conical, and present edges having a frilled appearance. Prof. M'Intosh remarks that in life the lamellæ of the feet as well as the branchiæ, which meet those of the opposite side in the front, are muscular and perform various movements.

The body-wall of this species is very thick and muscular, and thus presents a condition totally different from that of many of the Eunicidæ, which have body-walls so thin that the fæces in the gut appear as green masses. I was unable to obtain any nephridia, but one fragment contained ova which were fairly large in size and opaque in colour. The gut, which was exposed in parts, is fairly wide and is covered by a white-coloured tissue which has been probably discoloured by the preserving fluid. The contents of the gut were sand, débris, and brown masses which appeared like pieces of tissue. It is doubtful whether the animals are carnivorous or not.

The fragments were taken along with several Polynoidæ which were worked out by Mr. W. Small.

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XX — *Note on the Mouth-parts in a Species of Polyplax (Anophua) and on the Relationship between Anoplura and Mallophaga.* By BRUCE F. CUMMINGS, British Museum (Natural History).

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ONE of the most interesting of recent memoirs on the Anoplura and Mallophaga is that published in the 'Arkiv för Zoologi' for 1910 *, by Dr. Eric Mjöberg of the Academy of Sciences, in Stockholm. In the course of this work, entitled 'Studien über Mallophagen und Anopluren,' the author brings forward a very considerable amount of morphological evidence, gleaned from various regions of the anatomy, showing good cause why the Anoplura, or blood-sucking lice (usually taken to be allied to the Rhynchota), should be regarded as more closely related to the Mallophaga—or mandibulate bird-lice. An account of previous views of the systematic position of the two orders is given on page 203, and a recapitulation is here unnecessary. Mjöberg links the Mallophaga with the Psocidæ and the Psocidæ with some Blattoid-like stem-form.

For the first time, Mjöberg has presented us with a more or less extended comparison of the two groups—system for system; and, by marshalling unmistakable likenesses in the genital organs, the tracheal system, the external morphology, and even the mouth-parts, has placed the intimate phylogenetic relationship of Anoplura and Mallophaga on a sound basis. The Anoplura, therefore, appear to be Mallophaga which have taken to sucking blood, and are modified accordingly. It has been suggested that some Mallophaga, such as

* 'Arkiv för Zoologi,' vi. 1910, pp. 1-296.

Tetrophthalmus titan (Piaget), which is found firmly attached by means of its powerful tridentate mandibles to the skin of the Pelican's pouch, lives on blood; a transition from hair- and feather-feeding to gnawing at the epidermis of the skin is easily conceived, when, as soon as blood is extravasated, it becomes a comparatively short jump for the imagination to figure how a complete change in feeding-habits came about.

In regard to the mouth-parts of the Anoplura with which this note more particularly deals, it was almost to be expected that a careful search would reveal traces of their mandibulate ancestry. Enderlein, already in 1904 *, likened two lateral pieces within the proboscis of *Hamatopinus suis* (L.), Leach (from the Pig), to the mandibles of *Corixa*, a Heteropterous bug. Enderlein regards the Anoplura as a suborder of the Rhynchota. But the pieces in the proboscis of *Arctophthirus tricheci*, Boh., described and figured by Mjöberg in the paper already named bear a direct resemblance to the mandibles of Mallophaga rather than to those of *Corixa*, which are remarkable in form and have a peculiar basal piece. Moreover, in a species of *Polyplax* from an Egyptian host—*Acomys cahirinus*, Des.,—about to be described under the name *P. oxyrhynchus*, there are two chitinous structures lying together behind the pharynx (*larynx* of Enderlein), which are quite probably mandibles, and closely resemble those figured by Mjöberg, *i. e.* each lies with its narrow end pointing inwards and a tendon-like strip of chitin runs back from the base of the posterior lateral angle. The mouth-parts of the louse form, of course, an almost classical problem in morphology, and many authors, from Swammerdam to Schiödt and after, have tackled it with varying success. The inherent difficulties in dissecting the proboscis probably constitute the reason why we still lack any very settled views on its structure and morphology, and the suggestions put forward here are therefore to be regarded as the advertisement of problems to be solved rather than as definite solutions.

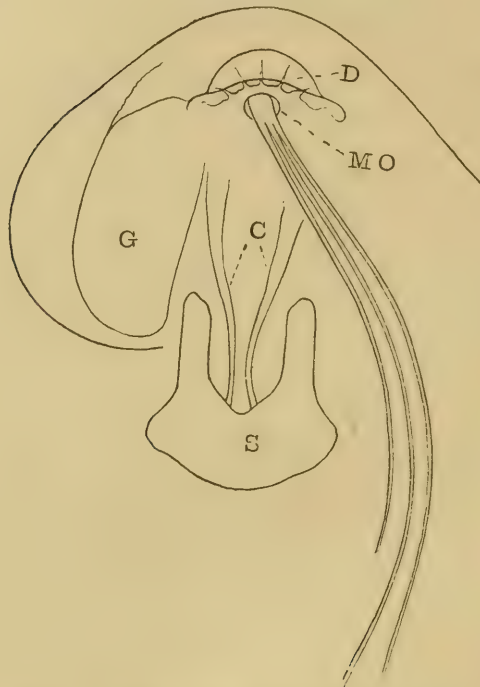
In another species—to be called *Polyplax brachyrhynchus*—from the same host, a still more interesting structure was found on the under surface of the head in front of the pharynx and just behind the mouth-opening.

A glance at fig. 1 (p. 258) is sufficient to suggest at once to a student of the Mallophaga the well-known oesophageal sclerite and "glands" which form a prominent feature in the

* Zool. Anz., Bd. xxviii. 1904, pp. 121-147.

literature of this group*. This sclerite (sometimes called "lyriform organ" and homologized with the hypopharynx) and glands (better known as basal pieces), almost unique in

Fig. 1.



Infra-buccal plate of *Polyptax brachyrhynchus* (Anoplura). The whole of the top of the head has been dissected away, so that the plate is seen from above. The bundle of elongated needle-like trophi, which are sketched in only diagrammatically, have been drawn on one side to leave the plate clear.

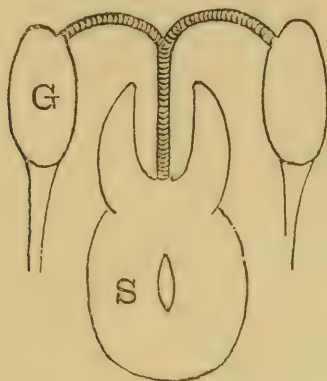
MO=Mouth-opening; D=Rostral denticles; S=Infra-buccal plate (or sclerite); C=Chitinous chords; G=? "Gland" (this was only visible on one side). Greatest length of the plate=.013 of a millimetre; greatest width=.016.

the comparative anatomy of the insect-mouth, occur in their typical form in the suborder Ischnocera of the Mallophaga

* Vide V. L. Kellogg, Proc. Calif. Acad. Sci. vol. vi. 1896. R. Snodgrass, Trans. Am. Ent. Soc. xxxi. Nr. 4, 1905, pp. 297-307; P. Z. S. 1913, p. 128. Armenaute, Boll. della Soc. di Naturalisti in Napoli, xxiv. (ser. 2, vol. iv.) 1910, p. 76.

(see fig. 2). A curious "duct" (or chitinous chord), cross-barred like a trachea, runs forward from between the anterior cornua of the sclerite and bifurcates in front, each branch running into a basal piece or "gland," which is, according to Armenaute, only a hard flat oval piece of chitin, without glandular structure.

Fig. 2.



Diagrammatic sketch of the oesophageal sclerite (or lyriform organ) and "glands" (or basal pieces) in Mallophaga.

G=Gland ; S=Sclerite.

The infra-buccal plate in *P. brachyrhynchus* is apparently fused at least in part with the lower wall of the head. It is extremely minute and correspondingly difficult to dissect, as the whole head itself in this species measures only .20 of a millimetre in length. The vestigial character of this plate and the two chitinous chords, which arise from between the two anterior horns by separate roots, is indicated by the delicacy and, in different specimens, by the varying outline of the parts. Both plate and chords are present in all specimens, however, and the former stains deeply with acid fuchsin. On one side in the specimen from which the drawing is made indications of a "gland" or basal piece were observed, and its outline is therefore given.

An infra-buccal plate is present in other species of *Polyplax*, including *P. spinulosa*.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

December 2nd, 1914.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The following communication was read:—

‘On the Age and Character of the Shippea Hill Man.’
By Prof. T. McKenny Hughes, M.A., F.R.S., F.G.S.

The Author first gives a general description of the skeleton, and of the position and circumstances in which it was found.

He then discusses the mode of formation of the deposit in which the remains occurred, and the limits within which, from that point of view, we may speculate as to their age.

He considers that the Pleistocene deposits of the Fenland were laid down in a gradually depressed river-basin behind a breached seaward barrier, and gives examples from adjoining areas of similar geographical conditions.

Gravels of the age of *Elephas antiquus* and *Rhinoceros merckii*, as well as gravels of the age of *Elephas primigenius* and *Rhinoceros tichorhinus*, occur within the Fenland; but they are easily distinguished from the gravels which are sometimes associated with the peat and clay, and pass under them. The fauna also of the peat- and clay-deposits is quite different.

This area was gradually depressed, and the conflict between the upland waters and the sea went on through both the ages just referred to, as shown by the earlier *Corbicula* Bed of March and the newer Cockle Bed of Littleport.

In an embayed part of the Fen, close behind the island known as Shippea Hill, the skeleton was found in the peat, a few inches above the clay which the Author considers to be the equivalent of this Littleport Cockle Bed.

When first dug out the skull was in fragments, and the calotte, with its prominent brow-ridges, suggested to many a greater affinity to the Neanderthal type, and a greater antiquity than appeared probable when the rest of the cranium was added to it.

In a preliminary notice published by the Author, he claimed that it could not be older than Neolithic, and suggested that it might be even as late as the time of the monks of Ely, who had a retreat on the island close by.

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THE ANNALS
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[EIGHTH SERIES.]

No. 87. MARCH 1915.

XXI.—*Descriptions and Records of Bees.*—LXV.
By T. D. A. COCKERELL, University of Colorado.

Mesotrichia cuernosensis, sp. n.

♀.—Length about 23 mm., anterior wing 24.

Very robust, black, thorax above (except a naked smooth shining space in middle of mesothorax, marked anteriorly by a groove) densely covered with short bright fox-red hair, intermixed with black; abdomen strongly and rather closely punctured, its hair entirely black, not hiding the surface. Head broad; face with mixed black and pale yellowish hair; on vertex the hair is mostly black, but on occiput ferruginous, on posterior part of cheeks above yellow, paler lower down, the lower part of cheeks with long black hair; mandibles bidentate; labrum with a very strong median tubercle; clypeus dull, very densely punctured, with a raised but not shining median line; ridge between antennæ obtuse, very feebly grooved; third antennal joint a trifle longer than next three together; flagellum, except basally, dull ferruginous beneath; tubercles and upper part of pleura with red hair, the rest with black; tegulæ black, basally with red hair. Wings very dark fuliginous, with rosy tints, the apical field with green; first t.-c. incomplete at lower end. Legs with black hair, anterior tibiæ with a fringe of yellow hair behind; hind femora with a small red button-like spot or lobe on each side apically; scale-like

process on hind tibiæ rather small, cariniform, rounded at end.

Hab. Cuernos Mts., Negros, Philippine Islands (*Baker*, 3125).

Closely related to *Mesotrichia insularis* (*Xylocopa insularis*, *Smith*), from Borneo, of which only the male is known. It is possible that *M. cuernosensis* is the hitherto unknown female of *insularis*, but, in view of the very different locality, it is much more likely that it is a distinct species. There is a superficial resemblance to the Japanese species *circumvolans*, *Smith*.

Mesotrichia dapitanensis, sp. n.

♀.—Length about 16 mm., anterior wing 14.

Broad, entirely black, except that the flagellum is dull ferruginous beneath (except basally), and the hind margins of the second and following abdominal segments are very narrowly reddish; pubescence all black, except a few coppery-red hairs in region of mouth. Wings strongly brownish, darker in apical field, reddened in marginal cell, with a greenish-golden iridescence, dilute rosy apically; head very broad; clypeus very densely punctured, with a shining median ridge; ridge between antennæ obtuse, distinctly but not deeply grooved; third antennal joint shorter than next three together; mesothorax smooth and shining in middle; tegulæ black. Abdomen well punctured; first t.-c. failing at lower end; scale-like process on hind tibiæ short, rounded, rather like a finger-nail.

Hab. Dapitan, Mindanao, Philippine Is. (*Baker*, 3128).

Resembles *M. bakeriana*, *Ckl.*, but much smaller, with the ocelli further apart, the wings paler and redder, and the process on hind tibiæ different.

Professor C. F. Baker sends other Philippine Xylocopids, as follows :—

Mesotrichia latipes (*Apis latipes*, *Drury*), ♀.—Cuernos Mts., Negros (3121).

Mesotrichia ghilianii (*Xylocopa ghilianii*, *Gribodo*), ♀.—Iligan, Mindanao (3124).

Xylocopa euchlora, *Pérez*, ♂.—Dapitan, Mindanao (3123).

Xylocopa major, *Maidl.*, ♂.—Malinao (3122).

Xylocopa fuliginata, *Pérez*, ♂.—Dapitan (3126); ♀. Iligan (3127, 3129).

Nomada bakeri, sp. n.

♀.—Length nearly 6 mm.

Slender, with clavate abdomen, narrowed basally; black, with the labrum, mandibles (except apices, which are simple), narrow band along posterior orbits, entire face below antennæ, narrow band along anterior orbits to top of eye (ending broadly above eye), upper border of prothorax, tubercles, pleura (but densely covered with silky white hair), scutellum (which is bigibbous, with strong irregular punctures), two small obscure spots on disc of first abdominal segment, a little more than basal half of second segment, basal corners of third and fourth segments and broadly interrupted band on fourth, fifth segment (except a spot at extreme base, and a large black patch on each side), all yellow, reddened by cyanide in type-specimen; labrum and face with pale ochreous hair; antennæ long, second joint conspicuous, third joint elongate, a little longer than fourth, scape ferruginous in front, flagellum black; mesothorax dull, densely punctured; area of metathorax large, less than the basal half rugose with irregular wrinkles; sides of metathorax very densely covered with pale ochreous-tinted hair; tegulæ clear ferruginous. Wings strongly dusky at apex, stigma and nervures picuous; b. n. going a little basad of t. m.; second s. m. receiving first r. n. about middle; third s. m. less than half as broad above as second. Abdomen smooth and shining, not punctured. Legs red and black, hind legs black with knees and apex of tibiæ red.

Hab. Mt. Makiling, Luzon (*Baker*, 3156).

Resembles *N. adusta*, Smith, which I have from the Khasia Hills, India (*Sladen*).

Nomada lusca, Smith.

♀.—Los Baños, Luzon (*Baker*, 3160).

Nomada makilingensis, sp. n.

♀.—Length nearly 5 mm.

Slender, the abdomen broad-fusiform, narrowed basally; bright clear ferruginous, flagellum strongly dusky above, first abdominal segment with a pair of large suffused blackened patches; mandibles simple; face, pleura, and sides of metathorax with thin clear white hair; antennæ long and slender, third joint about as long as fourth; mesothorax densely punctured, but shining between the punctures;

area of metathorax roughened at extreme base; tegulae light rufo-testaceous, much smaller than those of *N. bakeri*. Wings dusky at apex, stigma and nervures dull sepia; b. n. going basad of t.-m.; only two submarginal cells, the second t.-c. absent. Abdomen smooth, the second segment with a large round yellow spot (reddened by cyanide in type) on each side.

Hab. Mt. Makiling, Luzon (*Baker*, 3155).

Nomada banahaonis, sp. n.

♂.—Length of type 6 mm., but of the smallest specimen about 4.5.

Slender, with fusiform abdomen, very narrow at base; black, with labrum, mandibles, band along lower part of posterior orbits, clypeus (except a pair of black patches above), lateral face-marks (ending in a sharp point on orbit about level of top of clypeus), tubercles (but no other part of thorax), small round spot on each extreme side of first abdominal segment, and large spots on each side of second and third (very large on second), all yellow, reddened by cyanide in type; mandibles simple; head broad, face with appressed silky pale hair; scape very long, black, with a red spot at base and apex; flagellum long and thick, ferruginous beneath; second antennal joint hardly visible, third short, not longer than broad, conspicuously shorter than fourth; mesothorax very densely punctured; area of metathorax rugose at base, otherwise shining, with slight transverse striation; pleura and sides of metathorax with dense white hair; tegulae rufo-piceous. Wings with apex and outer margin broadly dusky, nervures and stigma piceous; b. n. going basad of t.-m.; second s.m. receiving first r. n. about middle. Legs black, with anterior femora in front and above, middle femora in front, anterior and middle tibiae in front, anterior tarsi, middle basitarsi, posterior knees and apex of posterior tibiae, all ferruginous. Abdomen smooth and shining, apex and apical plate ferruginous, the latter strongly notched.

Hab. Mt. Banahao, Philippine Is. (*Baker*, 3157=type; 3158, 3159).

This may possibly be the male of *N. lusca*, but I believe it is distinct. In Desc. Rec. Bees, lxiii. p. 365, *Halictus banahaonis*, also from Mt. Banahao, and very possibly the host of the present *Nomada*, is misprinted "*banabraonis*."

Nomada mindanaonis, sp. n.

♂ (=type).—Length 4.5–5 mm.

Like *N. banahaonis*, but differing thus: scape shorter and stouter, broadly dull yellow on outer side; third antennal joint very long, a little longer than fourth, which is also long; flagellum entirely black; a small light mark above each eye (a faint trace of this can be seen in *banahaonis*); markings of abdomen and legs suffused and dull, venter of abdomen ferruginous.

♀.—Length a little over 5 mm.

Like *N. lusca*, but smaller, clear bright ferruginous, the abdomen without dusky shades, except a suffused elongate black mark on each side of first segment; scape red, flagellum very long, black; third antennal reddish beneath, very long, conspicuously longer than fourth; b. n. going basad of t.-m.; area of metathorax rugose basally; a patch of pure white hair on each side of metathorax.

Hab. Dapitan, Mindanao (*Baker*, 3153, 3154).

The following table separates the above species, and also those described from Borneo and Java. The Sumatran species which doubtless exist are unknown:—

Females	1.
Males	6.
1. Two submarginal cells; small clear red species, with large round yellow spot on each side of second abdominal segment.....	<i>makilingensis</i> , Ckll.
Three submarginal cells	2.
2. Second abdominal segment marked with white; black species with red thorax (Borneo)	<i>malayana</i> , Cam.
Second abdominal segment not so marked....	3.
3. Head and thorax red-brown; abdomen black or black-brown, marked with yellow (Java) .	<i>javanica</i> , Friese.
If head and thorax red, abdomen also red	4.
4. Black, with scutellum and basal half of first abdominal segment yellow.....	<i>bakeri</i> , Ckll.
Red	5.
5. Hind margins of abdominal segments suffused with dusky; flagellum dull red beneath....	<i>lusca</i> , Smith.
Abdomen clear red; flagellum black	<i>mindanaonis</i> , Ckll.
6. Tegulae yellow or brownish yellow; insect black, with only the tubercles, tegulae, and spots on abdomen yellow (Java)	[<i>biroi</i> , var.).
Tegulae dark	<i>nigrescens</i> , Friese (as
7. Third antennal joint long	7.
Third antennal joint short.....	<i>mindanaonis</i> , Ckll.
	<i>banahaonis</i> , Ckll.

N. testaceobalteata, Cam., ♂, from Borneo, is at once distinguished by the rufous thorax, that of the Philippine and Java males being black.

Lithurgus scabrosus (Smith).

♀.—Dapitan, Mindanao (Baker, 3135). *L. guamensis*, Ckll., is very closely allied, and may prove to be a form of *scabrosus*.

Megachile clotho, Smith.

♀, ♂.—Dapitan, Mindanao (Baker, 3133, 3134).

Prosopis pulchricrus, sp. n.

♂.—Length about 5 mm.

Very robust; black, with the face creamy white, and the tubercles (except for a dark dot) of the same colour, but all the rest of the thorax and abdomen dark, the hind margins of the abdominal segments very obscure reddish; femora clear pale ferruginous, more or less cream-coloured apically, tibiae of the same red with the base (half of outer side of hind pair) cream-colour, tarsi pale red, the hind basitarsi cream-colour except at apex. Face broad, the long clypeus, labrum, mandibles, large equilaterally triangular supra-clypeal mark, and lateral face-marks (filling space between clypeus and eye, and extending upwards, rapidly narrowing to a point on orbital margin somewhat below middle of front) all creamy white; front just above antennae with fine appressed plumose white hairs; front and mesothorax very densely, rather coarsely (for such a small insect) punctured; antennae rather short for a male, light ferruginous, scape cream-colour in front, third and fourth joints extremely short; tegulae testaceous with a light yellow spot. Wings milky hyaline, nervures and stigma fuscous; first r. n. joining second s.m. not far from base. Abdomen broad, very finely punctured; venter without projections, first ventral segment with broadly hyaline margin.

Hab. Yarrawin, N.S.W. (*Froggatt*, 248c).

In my table of Australian *Prosopis* this runs to 34, and runs out on account of the creamy-white face. It is a very distinct species.

Allodape diminuta, sp. n.

♂, ♀.—Length about 5 mm.

Resembling *A. simillima*, Sm., but male with scape white in front, and both sexes much smaller. Tubercles and scale at base of wings cream-colour; hind basitarsi of male cream-colour, with the small joints ferruginous. Face-mark in

female broad and pyriform ; in male very broad, constricted below middle, with a narrow lateral mark (sharply pointed above) on each side. Pleura of male not conspicuously hairy as it is in *A. simillima*.

Hab. Yarrawin, N.S.W. (*Froggatt*, 219 c), 2 ♂, 1 ♀.

Evidently a distinct species, but close to *A. simillima*. The form of the face-mark in the female readily distinguishes it from *A. unicolor*, Sm.

Exoneura clarissima, sp. n.

♂.—Length about 5 mm.

Black, the abdomen bright ferruginous, dusky at sides of apex, and the first segment black with a narrow red apical margin ; mandibles black, with a broad orange band just before the apex ; labrum and clypeus white, the white of the clypeus notched on each side below the middle, and the part below the notch appearing especially broad because a very narrow white lateral face-mark (not reaching eye) is contiguous with it on each side ; eyes large, but not remarkably so ; scape and second antennal joint white in front, flagellum dull ferruginous beneath ; thorax shining ; tubercles apically white. Wings hyaline, not reddened ; knees broadly, and all the tibiae and tarsi, bright ferruginous.

Hab. Yarrawin, N.S.W. (*Froggatt*, 224 c).

Readily known by the small size and broad white face-patch, broadly truncate above. There are several small species known only in the female, but it does not seem probable that *E. clarissima* belongs with any of them.

Andrena jacobæa, sp. n.

♀.—Length a little over 12 mm.

Black, the head, thorax, and two basal segments of abdomen with ferruginous hair, very bright fox-red on head and thorax above, but black on upper half of cheeks, sides of front overlapping foveæ, and lower part of sides of metathorax ; legs with hair mostly black, but dark coppery reddish on inner side of tarsi, light ferruginous on under side of anterior and middle femora, long and abundant on anterior femora ; long curled floccus on hind trochanters also light ferruginous ; first two dorsal abdominal segments with fulvous hair, the others with black hair, with fulvous intermixed on third, and slightly on fourth ; venter with black hair. The abdomen is not at all banded. Facial quadrangle

broader than long; clypeus shining, with rather small well-separated punctures, and a smooth median line; malar space short, but distinct; process of labrum broadly truncate, with a transverse sulcus; front dull and granular; facial foveæ dark, not hairy, rather broad, reaching a little below level of antennæ; cheeks very broad, with a little tubercle on hind margin a little above level of middle of eye; antennæ black, third joint longer than next two together, but not quite so long as next three together; mesothorax and scutellum dull and granular; area of metathorax feebly defined, minutely granular; tegulæ piceous, with much red hair. Wings dusky translucent, nervures and stigma reddish brown; h. n. falling just short of t.-m.; second s.m. nearly square, receiving first r. n. beyond the middle but not near end; third s.m. extremely broad above; hind tibial scopa of mostly simple hairs, rather short and thin. Abdomen shining, without evident punctures, second segment depressed hardly a third; hair at apex black; apical plate rather narrow.

Hab. Jimtown, Colorado, at flowers of *Thermopsis*, June 7 (Cockerell).

The specimen is stylopized, and perhaps somewhat altered, but it appears to be a quite distinct species. It is very like *A. milwaukeeensis*, Graenicher, but differs by the light hair on the face and pleura, the broad cheeks, &c. There is evident close affinity with *A. ribesina*, Ckll., but the third s.m. is very much broader above, the small joints of tarsi are dark, the hair on the abdomen is differently coloured, and the cheeks are broader and flatter. It is perhaps possible that the insect is an extreme variety of *A. ribesina*. In the key in Proc. U.S. Nat. Mus. vol. xlviii. pp. 1-58, it runs nearest to *A. topazana*, Ckll., which is smaller and otherwise distinct.

Megachile parallela, Smith.—Males and labelled as follows: Dallas, Texas, at *Gaillardia pulchella*, May 19 (Bishopp); N. Braunfels, Tex., at *Ratibida columnaris*, May 17 (Crawford and Pratt); Barstow, Tex., Oct. 12 (Crawford); Denton, Tex., at *Gaillardia pulchella*, May 29 (Bishopp); Cotulla, Tex., at *Verbesina encelioides* and *Monarda punctata*, Apl. 18-May 12 (Crawford and Pratt).

Anthophora smithii, Cresson.—Ward, Colorado, alt. 9200 ft., male at flowers of *Grindelia subalpina*, Aug. 26, 1913 (Cockerell).

- Anthidium emarginatum* (Say).—A male, with two black spots on upper part of clypeus. Between Ward and Peaceful Valley, Colo., July 5 (*Cockerell*).
- Augochlora fervida*, Smith.—About four miles N. of Boulder, Colo., at flowers of *Petalostemon oligophyllus*, June 18, 1 ♀ (*T. & W. Cockerell*).
- Augochlora confusa coloradensis* (Titus).—A female, peculiar for having transverse as well as longitudinal wrinkles on the area of metathorax, but otherwise normal. About four miles north of Boulder, Colo., June 18 (*T. & W. Cockerell*).
- Colletes myroni*, Ckll., variety *a*.—Hair of thorax above creamy white, a little redder on scutellum; pleura with some of the hair more or less pale. 1 ♀, Boulder Cañon, Colo., at flowers of *Phacelia heterophylla*, June 21 (*Cockerell*). Also a ♀ with similar light hair above, but hair of pleura all black, from between Ward and Peaceful Valley, Colo., July 5 (*Cockerell*).
- Andrena lupinorum*, Ckll., ♀.—Between Ward and Peaceful Valley, Colo., July 5 (*Cockerell*).
- Osmia wardiana*, Ckll., ♀.—Timber line on Mt. Martha Washington, Colo., at flowers of *Tetaneuris*, June 25, 1913 (*Cockerell*).
- Melissodes hymenoxidis*, Ckll., ♀.—Ward, Colo., 9200 ft., Aug. 26, 1913 (*Cockerell*).
- Clisodon terminalis* (Cress.).—Bikerdike Ranch, near Allen's Park, Colo., at flowers of *Gentiana affinis*, Aug. 27, 1913 (*Cockerell*). 1 ♀.
- Prosopis basalis*, Smith.—Between Ward and Peaceful Valley, Colo., July 5 (*Cockerell*). 1 ♂.

XXII.—Notes on the Tabanidæ of the Australian Region.

By GERTRUDE RICARDO.

[Continued from ser. 8, vol. xiv. p. 397.]

THE type of *Tabanus transversus*, Walker, described in the first part of this paper ('Annals,' ser. 8, vol. xiv. 1914, p. 390), came from Auckland, New Zealand.

The species of *Tabanus*, so far recorded from the Celebes, are the following:—

Group V.

Tabanus vanderwulpi, Osten Sacken.

Tabanus flexilis, Walker.

Group VI.

Tabanus speculum, Walker.

Group VII.

Tabanus reducens, Walker.

Group VIII.

Tabanus humillimus, Walker.

Tabanus factiosus, Walker.

Tabanus succurvus, Wlk.

Tabanus spoliatus, Walker.

Group IX.

Tabanus immixtus, Walker.

Of these, *T. vanderwulpi* and *T. factiosus* are also recorded from the Philippines, and *T. humillimus* is also found in Java.

Group VI.

Wings distinctly marked with brown or yellow colouring,
but not in the form of bands.

Tabanus speculum, Walker, Proc. Linn. Soc. v. p. 258 (1861);
Ricardo, Records Indian Museum, iv. p. 143 (1911);
id. Tyd. v. Entom. liv. p. 348 (1912).

Type (female) from Menado, Celebes, and another from Toli-Toli, N. Celebes.

Type (male) in German Entomological Museum, also from Celebes.

Two males and two females from Toli-Toli, N. Celebes, in Mr. Wainwright's Coll.

This species appears as yet only recorded from Celebes, and the male has not been previously recorded. A handsome fly with very dark brown wings, the discal cell clear. Abdomen black with grey spots. Scutellum grey.

Length, ♂ 21 mm., ♀ 22 mm.

Face covered with brown tomentum, but with a white triangular spot in the centre, with rather thick black pubescence. *Beard* black. *Palpi* large, ending in an obtuse point, dull reddish yellow with black hairs. *Antennæ* dull reddish yellow but paler, the first two joints with black hairs. *Forehead* very narrow, quite ten times as long as it is broad, and only half as broad anteriorly as it is at the vertex; frontal callus reddish brown, not reaching the eyes, narrow with a long lineal extension. *Thorax* black, with traces of grey tomentum anteriorly, and with black and dull reddish inconspicuous pubescence, and a tuft of white hairs above and below base of wings. *Scutellum* covered with ashy-grey tomentum and with white hairs. *Abdomen* black, the ashy-grey spots are situated on the second and third segments, and sometimes there is a trace of one on the fourth segment, almost semicircular in shape, with some white hairs, pubescence otherwise on dorsum black. *Legs* black, the pulvilli golden brown. *Wings* rich brown in colour with streaks of white in the centre of most of the cells, the discal cell almost entirely clear, and the base of the second submarginal cell pale, the apex on its posterior border quite clear, as far as the sessile ending of the first posterior cell.

Male is similar, the head large, the large facets of eyes occupying not quite two-thirds of the surface. *Palpi* reddish brown, with thick black pubescence.

Group VII.

Species with one or more stripes, usually continuous, on abdomen.

Tabanus concolor, Walker, List Dipt. i. p. 179 (1848).

Type (female) from New Holland (*Hunter*).

A dull-coloured species, not in very good preservation. *Antennæ* blackish. *Abdomen* hair-brown, with a faint grey tomentose median stripe. *Legs* brownish, the tibiæ reddish.

Length 12 mm.

Face yellowish white with white hairs. *Beard* white.

Palpi pale yellow, stout on basal half, the apical half ending in a fine point, with yellow and black hairs. *Antennæ* blackish. *Forehead* about a third narrower anteriorly than at vertex and about six times as long as it is broad anteriorly; frontal callus long and narrow, not reaching the eyes. *Thorax*, *scutellum*, and *abdomen* very much the same colour, all denuded. *Abdomen* narrow, median stripe with traces of white hairs, which are also present at the sides. *Wings* clear, shaded pale brown along the longitudinal veins, stigma and veins yellowish.

Tabanus pseudoardens, Taylor, Austr. Inst. Trop. Med. 1911, p. 66, pl. xiv. fig. 18 (1913); Austen, Ann. & Mag. Nat. Hist. (8) xiii. p. 265 (1914).

This narrow-bodied mummy-brown species, measuring 12-13 mm., comes from Queensland. *Palpi* long and slender. *Forehead* narrow, parallel, frontal callus oblong, raised, with a lineal extension. *Abdomen* with a yellow-haired indistinct median stripe. *Legs* reddish brown.

Group VIII.

Species with median or lateral spots, or both, on abdomen, not usually forming a continuous type.

Tabanus propinquus, Macquart, Dipt. exot. Suppl. v. p. 47 (1854), described as in Mr. Bigot's Coll. from Sydney, is probably lost, as it is not among the types sent me by Mr. Collins from the late Mr. Verrall's Coll. It is described as black with three series of white spots on the abdomen. Legs black, tibiæ testaceous.

Length 18 mm.

Part of the abdomen was wanting when described.

Tabanus leucophilus, Walker, List Dipt. i. p. 154 (1848).

Type (female) from New Holland.

A stout species with pale whitish wings, abdomen blackish with three rows of white spots. *Antennæ* reddish.

Length 19 mm.

A species very easily recognized. Is it possible that it does not belong to this region at all? I have seen nothing like it as yet in collections from Australasia.

Face covered with ashy-grey tomentum and with long pale yellow hairs. *Palpi* canary-coloured, stout, ending in a short point, pubescence apparently black. *Antennæ* broken off, described by Walker as ferruginous, the first two joints

have black hairs. *Forehead* parallel, about five times as long as it is wide anteriorly, same colour as face with whitish hairs; frontal callus reddish yellow, pear-shaped, not reaching eyes, with a short lineal extension. *Thorax* (denuded) reddish, with three narrow grey tomentose stripes. *Scutellum* identical. *Abdomen* broad, short, the spots are triangular, covered with whitish tomentum, commencing from the second segment; underside blackish with grey-haired segmentations. *Legs*: femora reddish brown; tibiæ pale whitish yellow; tarsi a little darker. *Wings* large, no appendix.

Tabanus præpositus, Walker, List Dipt. i. p. 158 (1848).

Type (female) and another female from Port Essington, and a female from locality not specified.

The varieties B. and Y. mentioned by Walker do not appear to be in the Brit. Mus. Coll.

A reddish-yellow species with indistinct black spots on the abdomen, palpi very pale, stout at base, ending in a long point. *Antennæ* and legs reddish yellow.

Length, type, 18 mm.

Face covered with pale greyish-yellow tomentum, hairs pale yellow. *Palpi* very stout on basal half, the apical part about the same in length as the basal part, pubescence consists of a few black hairs and some yellow ones at base. Beard yellowish. *Antennæ* reddish, the basal joints pale yellow with black pubescence. *Forehead* almost parallel, the same colour as face, about six times as long as it is wide anteriorly; frontal callus dark brown, oblong, not reaching the eyes, with a lineal extension. *Thorax* blackish, covered with grey tomentum, pubescence chiefly black, shoulders pale reddish. *Scutellum* identical. *Abdomen* tawny, a dull black median triangular spot on the second segment, in the two other females there is a similar one on the second segment, and another on the third segment in type and other females, the remaining segments with larger more band-like spots on the anterior borders, pubescence consists of short yellow and black hairs; underside pale reddish yellow with grey tomentum. *Legs* uniformly reddish yellow. *Wings* clear with reddish-yellow stigma and veins, no appendix present.

Tabanus innotabilis, Walker, List Dipt. i. p. 177 (1848).

Tabanus dorsobimaculatus, Macq. Dipt. Exot., Suppl. iv. p. 29 (1850).

Type (of *T. innotabilis*) and another female in Brit. Mus.

Coll., and two females in Mr. French's Coll., both from Endeavour River, Queensland. Walker's type was described from an unknown locality, the other female from New Holland. Both specimens from Endeavour River have been compared with the Macquart type in the Paris Museum by myself and Monsieur Surcouf. I consider them also identical with Walker's type.

A medium-sized brownish species with indistinct median grey spots on the abdomen. Forehead narrow, antennæ and legs reddish.

Length $12\frac{1}{2}$ –15 mm.

Face covered with greyish tomentum, and with some few pale hairs. Beard yellowish. Palpi yellow with black pubescence, stout, ending in a fairly fine point. Antennæ reddish yellow, dusky at apex, the first two joints with black hairs, the third rather broad at the base with a distinct angle. Forehead narrow, about eight times as long as it is broad anteriorly, a third narrower anteriorly than at vertex; the frontal callus chocolate-brown, oblong, taking up nearly the whole space between the eyes, with a narrow lineal extension. Eyes bare. Thorax blackish with grey tomentum. Scutellum appearing reddish, being denuded. Abdomen tawny, with grey tomentose median spots not forming a continuous stripe, on all the segments, commencing from the second one, on which the spot is largest, being triangular, pubescence on dorsum black; underside the same colour with pale segmentations. Legs with femora reddish, the tibiæ chamois-leather with black pubescence, tarsi blackish at apex. Wings clear, stigma and veins yellow, no appendix.

Walker's type is in poor condition, but appears to be identical with the specimens I compared with type in the Paris Museum.

Tabanus factiosus, Walker, Proc. Linn. Soc. London, iv. p. 102 (1859); Ricardo, Records Indian Museum, iv. no. vi. p. 179 (1911).

Tabanus fastiosus, Kertész, Cat. Tabanidarum, p. 49 (1900).

Tabanus succurvus, Walker, Proc. Linn. Soc. iv. p. 102 (1859).

The female type of *Tabanus succurvus*, Walker, from Macassar, Celebes, the same locality as that of *Tabanus factiosus*, appears to me identical with this latter species, though a dark-coloured specimen, the tibiæ being only dull reddish at base (not yellowish), and the spots on the abdomen not visible, probably owing to denudation; the beard

and hairs on face are brown, not white as in the type of *Tabanus factiosus*. The two males from the Philippines, which I placed under *T. factiosus*, also have the beards brown.

Tabanus spoliatus, ♂, Walker, Proc. Linn. Soc. London, iv. p. 103 (1860).

Type (male) from Macassar, Celebes, and another male from Celebes (Wallace Coll.).

These males are allied to *Tabanus rubicundus*, Macq., from India and Java.

A reddish-yellow species measuring 19–20 mm. *Eyes* with facets all equal. *Antennæ* reddish, the third joint dusky. *Abdomen* tawny, with traces of yellow or whitish-haired median spots, and yellowish hairs on segmentations, apex of abdomen blackish, a black spot on the second segment in the centre; the other male has traces of paler bands on the segmentations, pubescence on dorsum consists of numerous short black hairs. *Thorax* and *scutellum* blackish. *Legs* reddish yellow, the femora black, the tarsi dusky. *Wings* clear, stigma and veins reddish yellow, no appendix present.

Tabanus claripennis, Bigot, Mém. Soc. Zool. de France, v. p. 675 (1892) [*Atylotus*].

The type in fair preservation is a female from Australia.

A small narrow-bodied species with a dull yellow-coloured *abdomen* and traces of round grey spots on sides and of a blackish spot on second segment. It may be at once distinguished by the shining red-brown subcallus united to the same-coloured, nearly square, frontal callus. The *forehead* is brown, narrower anteriorly, barely four times as long as it is broad. *Palpi* pale yellow, short and stout with black and some white hairs. *Antennæ* were incomplete when described by Bigot. *Wings* clear, stigma yellow.

Length 12 mm.

Tabanus victoriensis, ♀, sp. n.

Type (female) and two other females, all from Dandenong Ranges, Victoria, in Mr. French's Coll. In Mr. Froggatt's Coll. one female from N. S. Wales. In German Ent. Museum two females from N. S. Wales. A stout black species with white-haired spots on the abdomen and veins of wings shaded with brown, the palpi pale yellow, very long and narrow. *Antennæ* and legs black, the tibiæ testaceous.

Length 19 mm.

Face black, covered with grey tomentum, which becomes yellower on the cheeks; two deep pits are present on face below the antennæ and one furrow on the lower part on each side; some black hairs below the antennæ, and on the cheeks some short yellowish hairs, which are longer and white below. *Palpi* yellow with black and some white pubescence, the second joint very long and narrow, almost the same width throughout, in one specimen they appear darker covered with grey tomentum. *Antennæ* large, black, the tooth rather prominent, the first two joints with grey tomentum and black pubescence. *Forehead* narrow, slightly wider anteriorly, black with grey tomentum; the frontal callus brown, shining, triangular, and continued as a fine line for a short distance only, not reaching the eyes, a short deep furrow is present in the centre of the callus; hind part of head with short black pubescence. *Thorax* blackish with shoulders and sides obscurely red, pubescence black with white intermixed on the dorsum, at the sides black anteriorly, white posteriorly; breast black with grey tomentum and white hairs. *Scutellum* black with grey tomentum and black pubescence. *Abdomen* black, sides of first two segments obscurely reddish, segmentations narrowly and faintly reddish, white-haired median spots on each segment small and ill-defined; pubescence of dorsum short, black, sides of segments with white hairs, the last three with black hairs; underside black with mouldy-grey tomentum, narrow pale segmentations, and black short pubescence. *Legs* brown, coxæ blackish with grey tomentum and white hairs; the femora with black pubescence above, white below; tibiæ reddish with black pubescence, tarsi with black pubescence. *Wings* hyaline, the veins broadly shaded with brown; veins brown, stigma dark brown. *Halteres* brown.

This species is not identical with *Tabanus limbatinevris*, Macq., Dipt. Exot. iv. p. 333, having been compared with the type; it may be at once distinguished by the smaller tooth of antennæ.

Group IX.

Species with paler bands, and sometimes spots on abdomen.

Tabanus limbatinevris, ♀, Macquart, Dipt. Exot., Suppl. ii. p. 33 (1846).

Type (female) in the late Mr. Verrall's Collection labelled "Van Diemen," and stated in the description as from Tasmania.

An easily recognized large reddish-brown species, the first posterior cell of wings closed, and all veins of wing shaded brown.

Length 20 mm.

Palpi yellow with black pubescence, fairly stout throughout their length, ending in an obtuse point. *Antennæ* reddish, black at apex, with a well-defined tooth. *Forehead* about eight times as long as it is broad, parallel; frontal callus oblong, chestnut-red, reaching eyes, with a long lineal extension. Eyes apparently bare. *Thorax* (denuded) reddish with darker stripes. *Abdomen* reddish brown, the dorsal white spots very indistinct owing to denudation. *Legs* described by Macquart as black; the tibiæ yellow, the anterior and posterior pairs black at apices.

Tabanus macquarti, Ricardo.

Tabanus limbatinevris, Macquart, Dipt. Exot., Suppl. iv. p. 333 (1852).

Macquart named two species *limbatinevris*, the one from Tasmania takes priority (1846).

Type (female) in the Paris Museum, from the east coast of New S. Wales, was examined by me in 1911, and a specimen from the Brit. Mus. Coll. compared with it, from Brisbane.

In Brit. Mus. Coll. are females from Moreton Bay, New S. Wales (Vigors's Coll.) ; from Brisbane (*H. Tryon*), Dec. 1903 ; from Burpengary and S. Queensland (*Dr. T. L. Bancroft*). In Mr. Froggatt's Coll., females from Queensland and Tweed River, New S. Wales. In Mr. Wainwright's Coll. a long series from Herberton, Kuranda, and Townsville, N. Queensland (*Dodd*), and females in the German Entomological Museum from the same localities and by the same collector.

An easily identified species, but somewhat variable in the colour of abdomen and in the length of the long tooth of third antennal joint. *Abdomen* black, often reddish at the sides, marked with white or yellowish-haired median spots on all segments except the last one, these extend as a very narrow, whitish-haired band to the sides where they expand somewhat; the underside with grey tomentose and white-haired bands. *Wings* clear, tinged brown, leaving the discal cell clear. *Forehead* almost parallel, about six times as long as it is wide; the frontal callus oblong with spindle-shaped extension, the forehead with greyish tomentum. *Palpi* long, fairly stout, ending in an obtuse point covered

with greyish tomentum and with white hairs on basal half. Beard white. *Antennæ* black, the first two joints with black hairs, the third joint with a distinct, very prominent tooth.

Length 15–18 mm.

Macquart's original description is as follows:—Black. Abdomen with segmentations and dorsal spots yellow tomentose, sides with testaceous spots. *Antennæ* and legs black. Wings with veins shaded brown. Length 7 lines (♀). Palpi almost as long as the proboscis, blackish with grey tomentum. Face and forehead pale grey; callus blackish, oblong, with a lineal extension. *Antennæ* with a fairly prominent tooth. Eyes naked. Thorax with some grey tomentum; a testaceous spot, blackish above the wings (?). Abdomen with the second segment obscurely testaceous at sides; underside with white segmentations, a little testaceous on the borders of the first three segments. Wings clear at base, from the apices of the basal cell all the veins are shaded with brown except at their apices, venation normal.

Most of the specimens from N. Queensland have the abdomen almost wholly black, not reddish at the sides of the first two segments, and the wings are somewhat darker on the fore border. The tooth of the third antennal joint is often as long as the first division of the joint, but all the specimens vary in the length of this tooth, which is always very conspicuous.

Tabanus sequens, Walker, List Dipt. i. p. 178 (1848).

Type (female) from Port Essington, N. Australia.

Var. B (female) from same locality, and females from S. Queensland (*Dr. T. L. Bancroft*), 1908; from Ching Do, N. Queensland, 26. 1. 1913 (*F. H. Taylor*), 1914.

A small tawny species; abdomen with a median stripe composed of pale-coloured hairs. *Antennæ* reddish yellow. Legs blackish, tibiae yellow.

Length 13 mm.

Face covered with grey tomentum and with white hairs on cheeks and lower part of face. Beard white. *Palpi* chamois-coloured, stout at base, ending in an obtuse point; pubescence black. *Antennæ* tawny, the first two joints pale yellowish, with thick black pubescence on their upper borders, apex of third joint dusky, tooth distinct. *Forehead* rather darker than face, with short black pubescence, parallel, about five times as long as it is wide anteriorly; frontal callus pear-shaped, with short lineal extension, not reaching eyes, reddish brown, shining. *Thorax* blackish brown, covered with some grey tomentum, leaving three indistinct

black stripes visible, also with some yellowish recumbent pubescence and longer black hairs, sides with long dark hairs, paler below base of wings. *Scutellum* identical, bordered with long yellowish hairs. *Abdomen* tawny, becoming darker at apex, the median spots, composed of short yellowish hairs, are short, triangular, forming a more or less continuous stripe from the second to the sixth segment; indistinct brownish marks are often present, even on the basal segments, becoming more distinct on apical segments; the pubescence on dorsum is rather thick, consisting of short black hairs and a few yellow ones intermixed on the second and third segments; hairs at sides are white, forming presumably the white stripes which Walker mentions; segmentations often grey tomentose; underside identical, with broader grey segmentations on the darker apical segments. *Legs* pale yellowish, the femora reddish brown, covered with white pubescence; apical joints of tarsi blackish, pubescence on tibiæ and tarsi black. *Wings* clear, veins brown, stigma yellowish brown; no appendix.

Var. B, described by Walker, has brown spots on the first and second segments.

Tabanus brevior, Walker, List Dipt. i. p. 188 (1848).

Tabanus anellosus, Summers, Ent. Notes London School Tropical Medicine, p. 226 (1912).

Type (female), in poor preservation, from Port Essington, N. Australia, and another female from same locality (*Gould*). This last was described by Walker as var. B of *Tabanus marginatus*, which is a *Sylvius* species (see Ann. & Mag. Nat. Hist. (7) viii. p. 296, 1901); in general appearance it certainly bears a strong resemblance to *Sylvius marginatus*, but may be at once distinguished by the absence of ocelli.

A very small reddish-brown species. Palpi yellowish, the same width throughout. Wings slender. Antennæ reddish yellow, with black tips.

Length $8\frac{1}{2}$ mm.

Face covered with ashy-grey tomentum. Beard yellowish. Antennæ tawny, the apical joints black, the first two joints and the small tooth with black pubescence. Palpi yellowish, with rather thick black and white pubescence. Forehead about five times as long as it is broad anteriorly, parallel; frontal callus brown, pear-shaped, not quite reaching eyes, with a rather stout lineal extension. Thorax denuded, reddish brown, with grey tomentum. Abdomen short and rather broad, tawny-coloured, with darker brown markings,

and the posterior borders of segments grey tomentose, forming narrow bands; pubescence on dorsum blackish. *Legs* reddish yellow, femora and tarsus darker. *Wings* clear, veins and stigma yellow.

Tabanus immixtus, Walker, Proc. Linn. Soc. iv. p. 103 (1860).

Type (female) from Macassar, Celebes.

A species allied to *Tabanus dorsobimaculatus*, Macq., and *Tabanus sequens*, Wlk., but distinguished from both by the very narrow forehead. Reddish yellow, abdomen with well-marked median grey spots and bands. Legs blackish, fore tibiae pale yellow on basal half, other tibiae reddish yellow.

Length 14 mm.

Face covered with ashy-grey tomentum and with a few long white hairs. Beard white. *Palpi* chamois-coloured, with black pubescence, only slightly stouter at base, ending in an obtuse point. *Antennae* reddish brown, the first two joints reddish yellow with black hairs. *Forehead* covered with darker tomentum than the face, very narrow, anteriorly only half the width that it is at the vertex; the frontal callus chestnut-brown, oblong, very narrow, almost reaching the eyes, prolonged as a lineal extension more than half the length of forehead. *Thorax* and *scutellum* blackish, with some grey tomentum; pubescence appears to have been largely pale-coloured; shoulders reddish, with black hairs. *Abdomen* tawny, the last three segments blackish; the triangular median spots appear most distinct on the second to the fifth segments, not forming a continuous stripe; the grey tomentose bands on the segmentations appear on every segment except the first and last one, and are narrow, becoming broader at the sides; pubescence on dorsum black, with longer black hairs on the apical segments; underside tawny, with lighter bands, the last two segments blackish. *Legs*: femora blackish, with grey tomentum and long white hairs; the fore tibiae with the basal half whitish or pale yellow, black at apex, the other tibiae tawny, with black hairs; all the tarsi blackish. *Wings* clear, with yellowish-brown shading, most marked on the first, second, and third longitudinal veins; no appendix present; stigma and veins reddish yellow.

Tabanus parvus, Taylor, Australian Inst. Tropical Medicine Report for 1911, p. 19 (1913); Austen, Ann. & Mag. Nat. Hist. (8) xiii. p. 266 (1914).

This is a small species, 8–10 mm. long.

Forehead almost parallel and about five times as long as it is broad; frontal callus pear-shaped. *Palpi* long and slender, only slightly stouter at the base, yellowish. *Antennæ* reddish. *Abdomen* in the specimen in Brit. Mus. Coll. reddish brown with grey segmentations and median spots. *Wings* with a long appendix.

Type recorded from Darwin, Northern Territory, the same locality as that of *Tabanus anellosus*, Summers (now a synonym of *Tabanus brevior*, Wlk.), which, Mr. Austen remarks, it closely resembles.

Tabanus townsvilli, ♂ ♀, sp. n.

Type (female) and two other females from Townsville, N. Queensland (F. P. Dodd, per Janson).

Type (male) from same locality.

A dusky, reddish-brown, medium-sized species, with very small, white-haired, median spots on abdomen. *Forehead* almost parallel. *Antennæ* pale yellow at base, the third joint blackish. *Legs* reddish yellow and black.

Length, ♂ ♀, 15 mm.

♀. *Face* covered with pale ashy-coloured tomentum and with fairly long white hairs. *Beard* white. *Palpi* pale yellow, with some short black hairs, very stout at base, ending in a short obtuse point; some white hairs are visible on underside at base. *Antennæ* with the first two joints reddish yellow, the first one largely covered on its outer side with ashy-grey tomentum, and with a few black hairs on its upper border; the second is very small, the third almost wholly blackish, with a small angle as tooth. *Forehead* almost parallel, about six times as long as it is broad, much darker than the face, covered with tawny tomentum and with black hairs; a streak of white hairs is visible on each side; frontal callus chestnut-brown, oblong or pear-shaped, small, not reaching the eyes, with a lineal extension. *Thorax* blackish brown, with three fairly well-marked grey tomentose stripes; dorsum with some grey tomentum and with tawny and black pubescence; tufts of white hairs at base of wings. *Scutellum* same colour, with a few tawny hairs and with long black hairs. *Abdomen* ochraceous tawny, appearing darker by reason of the thick, short, black pubescence on the whole dorsum; the median spots are situated on second to the fifth segments, and consist of grey tomentum covered with a few pale yellow or white hairs; in two specimens the spots are very small, in the third larger and triangular; underside paler, with grey tomentum. *Legs* reddish

yellow, the femora blackish, with long white hairs and grey tomentum; the fore tibiæ blackish on their basal halves, the tibiæ dusky. *Wings* clear, stigma yellow, veins reddish yellow; no appendix present.

♀. Similar, the median spots of *abdomen* hardly visible. Eyes with the large facets occupying two-thirds of the surface, reaching beyond the apex of the frontal triangle. *Legs* are wanting.

Tabanus germanicus, ♀, sp. n.

Type (female) and a series of females from Cairns and Herberton, N. Queensland, in German Ent. Museum.

A small species, with slender pale yellow palpi, red antennæ, and yellowish-brown legs. Forehead narrow. Abdomen reddish brown, with grey bands and spots.

Length 9 mm.

Face covered with greyish tomentum and with a few scattered white hairs. Beard white. *Palpi* pale yellow, slender, a little stouter at base, ending in a long fine point; pubescence white and yellow. *Antennæ* bright reddish yellow, the first two joints pale yellow with black pubescence, the third with the basal joint large and broad, the tooth obtuse. Subcallus often partially denuded, when it appears shiny and testaceous in colour. *Forehead* parallel, nearly five times as long as it is broad, covered with yellowish tomentum and with some short black hairs; frontal callus shining reddish brown, pear-shaped, not reaching eyes, with a very short lineal extension. Eyes bare. *Thorax* blackish brown, but in well-preserved specimens appearing grey, being covered with grey tomentum, the pubescence consisting of appressed scattered yellow hairs, with a few longer black hairs; breast grey, with long white hairs. *Scutellum* same as thorax. *Abdomen* reddish brown (when denuded reddish and darker at apex), the grey bands on posterior borders of segments almost half as wide as the segment, narrower on the second one, and altogether absent on the first segment, composed of grey tomentum with yellowish pubescence; there are indications of grey median triangular spots of the same composition; underside reddish at base, darker at apex; pubescence of dorsum on the parts not occupied by the grey bands is black and rather dense, on underside white. *Legs* yellowish, the femora at base blackish, with grey tomentum and white hairs, often prolonged on the outer side; basal half of fore tibiæ and apices of others blackish brown, all the tarsi dark; pubescence on tibiæ black intermixed with

white hairs, on tarsi black. *Wings* clear, veins brown; a long appendix present.

Tabanus neogermanicus, sp. n.

Type (female) and a series from Palmerston, N. Australia, in German Ent. Museum.

A small species very similar to *Tabanus germanicus*, but apparently a distinct species, the third joint of antennæ with its first division being much narrower at base and the tooth more distinct; the joint rapidly becoming narrower beyond the tooth.

Forehead a little broader, about four times as long as it is broad, also parallel; frontal callus identical, rather narrower. *Thorax* and *scutellum* identical. *Abdomen* very similar, reddish brown, the grey bands not so marked and the white pubescence on them reduced to a few hairs on the segmentations, the black pubescence longer, especially at apex. *Legs* wholly reddish yellow, a little grey tomentum on the fore femora chiefly white, elsewhere black.

Length 9-14 mm.

Tabanus notatus, ♀, sp. n.

Type (female) from Ching Do, N. Queensland, 25. i. 1913 (*F. H. Taylor*), 1914, 281.

A well-marked black species, with large, triangular, grey median spots and bands on the abdomen. Antennæ black, palpi pale yellow. Legs black and yellow.

Length 14 mm.

Face covered with whitish tomentum and with long white hairs below antennæ and on the cheeks. Beard white. *Palpi* chamois-coloured, stout, ending in a point; pubescence black, with a few white hairs on the upper sides. *Antennæ* black, the third joint stout, with a very small tooth; the four last divisions about a third of the length of the basal first division. *Forehead* and subcallus covered with yellowish-brown tomentum, the forehead nearly a third narrower anteriorly, about seven times as long as it is broad anteriorly; frontal callus oblong, narrow, not reaching the eyes, with a lineal extension. *Thorax* blackish, with grey tomentum; pubescence black, with some white hairs on anterior border and at sides; five narrow blackish stripes discernible. *Scutellum* blackish, with grey tomentum and some tawny hairs on its outer border. *Abdomen* black, with well-marked, narrow, grey tomentose bands on each segment, and the median grey spots on every segment except

the last two; pubescence on the bands and spots white, elsewhere black; underside black, with fine white pubescence covering it. *Legs* black, the fore tibiae on their basal third, and the other tibiae wholly, pale reddish yellow, with white pubescence; femora with white hairs; pubescence elsewhere black. *Wings* clear, stigma reddish brown, veins brown; no appendix.

Tabanus cyaneus, Wied. Ausszweifel. Ins. i. p. 152 (1828).

Tabanus cyaneoviridis, Macquart, Dipt. Exot., Suppl. iv. p. 334 (1849).

Wiedemann described his type from a specimen caught in unknown locality with the antennae and legs wanting. Macquart's type is in the Paris Museum from Tasmania, and has been examined by me. Specimens are in the Brit. Mus. Coll. from Sydney, N. S. Wales ('Challenger' Expedition); from Brisbane, l. iii. 1902 (*H. Tryon*), 1912; from South Queensland (*Dr. T. L. Bancroft*); from Stannary Hills, North Queensland, circa 3000 ft. (*Dr. T. L. Bancroft*); also from Burpengary, South Queensland, by the same collector; from Inkerman, near Townsville, N. Queensland (*W. Stalker*), 1908.

This well-known species is easily recognized, being a shining blue-black metallic colour. The *antennae* bright reddish yellow, the two basal joints black. *Palpi*, *face*, and *forehead* black, the latter parallel, narrow, with a pear-shaped shining black frontal callus; the lineal extension stout, reaching the vertex. *Legs* black. *Wings* clear, dark brown at the base; stigma yellow, veins brown.

Length from 13-14 mm.

Group X.

Species with the abdomen unicolorous or almost so, sometimes darker at apex.

Tabanus funebris, Macq. Dipt. Exot., Suppl. i. p. 161, pl. iii. fig. 12 (1845).

A species from New Holland, which I have not been able to identify, the type being apparently lost.

It is described as entirely black, the margins with the veins shaded brown, as shown in the figure.

Length 11 mm.

Tabanus nigrimanus, Walker, List Dipt. i. p. 183 (1848).

Tabanus badius, Summers, Ann. & Mag. Nat. Hist. (8) x. p. 225 (1912).

Type (female) from Port Essington, Northern Territories, S. Australia (*Macgillivray*). Presented by the Earl of Derby, 46. 73.

The specimen of *Tabanus badius* in the Brit. Mus. Coll. is from Port Darwin, Northern Territories (*Dr. C. F. Strangmann*). Presented by London School Tropical Medicine.

A small species with a tawny abdomen. *Palpi* stout at base, ending in a long fine point. *Antennæ* tawny. *Forehead* parallel, about six times as long as it is broad anteriorly; the frontal callus chestnut-brown, oblong, not reaching the eyes, with a lineal extension. *Legs* reddish yellow, tibiae dusky.

Length 10 mm.

Tabanus diminutus, Walker, List Dipt. i. p. 183 (1848).

Type (female), in poor preservation, from Port Essington, N. Australia.

This type bears a very strong resemblance to *Tabanus avidus*, Bigot, from Australia and Sydney, but is apparently a distinct species, the *palpi* being stouter, the frontal callus a different shape, and the tooth of antennal third joint is smaller. The *palpi* are stout at base for quite half their length, ending in a fine sharp point, pale yellow in colour, with chiefly yellowish pubescence. The *antennæ* are tawny, a little dusky at tip; the tooth is little more than an angle, at the base of the third joint. *Forehead* slightly narrower anteriorly, about six times as long as it is broad anteriorly; frontal callus dark brown, oblong, not reaching eyes, with a lineal extension. *Abdomen* same colour as in *T. avidus*, with the trace of a darker spot on the second segment; apex somewhat darker in colour. *Legs* wholly yellowish; tarsi dusky at tips.

Length 13 mm.

The state of the type precludes a fuller description. It is distinguished from *Tabanus nigrimanus*, Wlk., by the yellow femora.

Tabanus constans, Walker, List Dipt. i. p. 186 (1848).

From N. and N.W. coast, Australia (*Presented by Mr. Bynce, Surgeon, R.N., Haslar Hospital*).

A very small species, in such poor preservation that it is difficult to describe it. *Palpi* appear reddish yellow, stout,

ending in a fine short point. *Antennæ* blackish. *Forehead* very protuberant, parallel, about three-and-a-half times as long as it is broad; the frontal callus chestnut-brown, rather heart-shaped, not reaching the eyes. *Thorax* and *scutellum* blackish, with remains of reddish-orange tomentum. *Abdomen* the same, with same-coloured pubescence. *Legs* reddish, dark at tips. *Wings* (only one is left) apparently brownish, but obscured by dirt.

Length 7 mm.

Tabanus aridus, Bigot, Mém. Soc. Zool. de France, v. p. 673 (1892) [*Atylotus*].

Tabanus fuscipes, Taylor, Report Australian Inst. Tropical Medicine, 1911, p. 14 (1913).

Tabanus taylori, Austen, Ann. & Mag. Nat. Hist. (8) xiii. p. 265 (1914).

Type (female) from Australia and another female from Sydney. The paratype of *Tabanus fuscipes*, given to the Brit. Mus. Coll. by the author, and renamed *Tabanus taylori* by Mr. Austen, the name *fuscipes* being preoccupied, on comparison with Bigot's type is identical, though it is described as from Queensland.

Tabanus posticus, Wied., Ausszweifel. Ins. i. p. 152 (1828), is possibly identical with this species, but it is impossible to speak with certainty without seeing Wiedemann's type.

Tabanus serus, Walker, Proc. Linn. Soc. vi. p. 20 (1862), from New Guinea, is nearly allied, but the forehead is narrower, the palpi stouter.

Forehead in Bigot's type is parallel, about six times as long as it is wide. A reddish-yellow species, the dorsum of thorax darker. *Legs* reddish yellow. *Wings* tinged brown.

Length 14 mm.

For detailed description see Mr. Taylor's account.

Tabanus hyperythreus, Bigot, Mém. Soc. Zool. de France, v. p. 674 (1892) [*Atylotus*].

Tabanus lorentzi, Ricardo, Résultats Expéd. Sci. Néerlandaise, Nouv. Guinée, ix. (3) p. 400 (1913).

Type (female), in fair preservation, from Australia, and a long series of females from Townsville and Kuranda, N.E. Queensland, in Mr. Wainwright's Coll.

Having examined Bigot's type, I find my species is identical, only differing in the colour of the legs, which is sometimes darker, the apical joints of tarsi often blackish, and the apex of antennæ is sometimes darker.

A medium-sized uniformly reddish-yellow species, with narrow hairy palpi, reddish legs, yellow antennæ, and clear wings.

Length 14 mm.

Tabanus sanguinarius, Bigot, Mém. Soc. Zool. de France, v. p. 675 (1892) [*Atylotus*].

In Brit. Mus. Coll. females from S. Queensland (Dr. T. L. Bancroft), 1908, and from Brisbane (H. Tryon), 1907.

In Mr. Wainwright's Coll. a female from S. Queensland. In Mr. Froggatt's Coll. three females from Richmond River, N. S. Wales, and from Tweed River.

In German Ent. Museum two females from New South Wales.

I have not seen the type, but the species is easily recognized by its large size and by its uniform reddish-brown abdomen. Legs red. Antennæ and palpi reddish yellow.

Length 18–19 mm.

Face covered with yellowish tomentum, and with some brown hairs in centre of face and on cheeks. Beard white. Palpi long, moderately stout, ending in an obtuse point, yellow, with black pubescence. Antennæ red, the first two joints with black hairs, the third slender, with a small but distinct tooth. Subcallus and forehead same colour as face, the latter almost parallel or slightly narrower at the vertex, about six times as long as it is broad; the frontal callus reddish brown, large, oblong, not reaching the eyes, with a stout lineal extension. Thorax reddish brown, when denuded four black stripes appear; some grey tomentum on dorsum, and the pubescence consists of scattered pale yellow recumbent hairs and some black hairs. Scutellum reddish brown, fringed with yellowish hairs. Abdomen reddish brown, slightly darker at the apex; pubescence on dorsum and at sides black; underside paler red, with grey tomentum and traces of yellow pubescence on the posterior borders of segments. Legs uniformly red, the apices of tarsi darker, the pubescence on coxæ white with grey tomentum, on femora yellow below, elsewhere black. Wings clouded more or less with brown, fore border and stigma yellow, veins yellowish.

This species must be very nearly allied to, if not identical with, *Tabanus nigropictus*, Macquart, the type of which was recorded from India; but as yet I have seen no specimens of it from the Oriental Region or elsewhere (see Ricardo, 'Records Indian Museum,' iv. no. vi. p. 210, 1911).

Mr. Froggatt records *Tabanus sanguinarius* under *T. nigropictus* in "March Flies" (Science Bull. New South Wales, No. 3, p. 8, 1911), as found near Richmond River, New South Wales.

Tabanus nigritarsis, Taylor, Report Austr. Inst. Tropical Medicine, 1911, p. 18 (1913).

This reddish-yellow species from Queensland, measuring 15–17 mm., may be distinguished from *Tabanus avidus*, Bigot [*Tabanus fuscipes*, Taylor, *Tabanus taylori*, Austen], by the *palpi*, which are swollen and stout at the base, ending in a rather long obtuse point; the frontal callus is narrower and the femora are blackish, not cinnamon-coloured.

Tabanus spatiosus, ♀, sp. n.

Type (female) and a long series from Stannary Hills, N. Queensland, circa 3000 ft. (*Dr. T. L. Bancroft*), 1901, in Brit. Mus. Coll.

A small yellowish-brown species, smaller than *Tabanus hyperythreus*, Bigot, from which it is distinguished by the wider forehead; this character also serves to distinguish it from *Tabanus nigrimanus*, Wlk. From *Tabanus nigritarsis*, Taylor, it may be distinguished by the colour of the legs.

Antennæ reddish yellow. *Palpi* pale yellow. *Legs* yellowish. *Wings* clear, with an appendix present.

Length $11\frac{1}{2}$ mm.

Face chamois-coloured, covered with grey tomentum on the cheeks; the sparse pubescence consists of short white or yellow hairs. *Beard* white. *Palpi* the same colour or a shade brighter, with short white and black hairs, slender, nearly the same width throughout, ending in a short point. *Antennæ* Mars-yellow, the first two joints paler, the third with its basal joint broad, and a small tooth. *Forehead* same colour as face, parallel, broad, about four times as long as it is broad anteriorly; the frontal callus dark brown, pear-shaped, not reaching the eyes, and with hardly any lineal extension. *Thorax* olive-coloured, with recumbent white pubescence and a few longer black hairs. *Scutellum* identical. *Abdomen* ochraceous tawny, the three last segments darker, with obscure brown markings, all segments covered with fairly numerous short whitish hairs, thickest on segmentations, and in the middle in the form of a faint stripe; underside identical. *Legs* ochraceous tawny, the femora sometimes with a dark streak; apical joints of tarsi

brownish; pubescence on femora white and on apical two-thirds of tibiæ, elsewhere black. *Wings* with yellowish stigma and veins.

Tabanus solomensis, ♂ ♀, sp. n.

Type (female) and type (male) from Solomon Islands, July–August, 1909 (*W. W. Froggatt*).

These specimens from Mr. Froggatt's Coll. are placed by him under *Tabanus ardens*, Wied., which was described from Java. He states this species is very common in the open forest-country of the Solomon Islands, and suggests it has a wide range over the Malay Archipelago (see "March Flies," by W. W. Froggatt, in Science Bulletin, No. 3, Sept. 1911, p. 6). Wiedemann's species is not known to me, but I do not think these are specimens of it, judging from Wiedemann's description (see translation of the original in 'Indian Records,' iv. no. vi. p. 224, 1911). The thorax in these is not mouldy grey, the palpi are not light brown, nor are the breast-sides mouldy grey. On the abdomen there is no trace of a golden-yellow spot, and it cannot be described as waxy yellow at sides; the golden-yellow pubescence on it is not mentioned by Wiedemann. Wings are not yellowish, but brownish. Halteres are black, not golden yellow.

No species of *Tabanus* has been described from these islands, and these specimens do not appear to be identical with any species hitherto described from New Guinea or adjacent islands—hence the decision to make it a new species.

A species to be recognized by the uniform ochraceous tawny colouring of thorax and abdomen, and the almost similar colouring of the antennæ, palpi, and legs. The extremely narrow forehead and frontal callus is characteristic, also the slender antennæ.

Length, ♀ 13 mm., ♂ 12 mm.

♀. *Face* and *forehead* ochraceous tawny. Beard scanty, reddish yellow. Palpi a shade lighter in colouring, almost the same width throughout, ending in a short point, with a few black hairs at tip, otherwise pubescence is yellow. *Antennæ* long and slender, the first two joints the same colour as palpi, the third dusky, the first division not very broad, with a very small tooth, the last four divisions together longer than the first one. *Forehead* parallel, very narrow, about ten times as long as it is broad; the frontal callus small and narrow, with a stout lineal extension, chestnut-brown in colour. *Thorax* has the ground-colour

obscured by brown indistinct stripes; dorsum shows little trace of any pubescence; sides with a few yellow hairs. *Scutellum* the same as thorax. *Abdomen* narrow, a little obscured by darker colouring, the last two segments brownish, golden-yellow short hairs appear on the segmentations, with the exception of the last two segments, where the pubescence is black; underside similar, with more golden-yellow hairs. *Legs* same colour as palpi or a shade darker and redder, rather shining; the tarsi dusky; pubescence on coxæ and femora yellow, elsewhere black. *Wings* dusky, on fore border and at base yellowish; stigma yellowish; veins reddish yellow; a small appendix present.

Male is similar. *Eyes* with the large facets reaching the apex of frontal triangle, but they are very little larger than the small facets below; the third joint of *antennæ* is only dusky on apical half. *Wings* are rather paler in colouring and the appendix is non-existent.

Tabanus aurihirtus, ♂ ♀, sp. n.

Type (female) and another from Townsville, Queensland (*F. P. Dodd*), 1904, 284.

Type (male) and another from same locality, 1902, 284, and 1903, 319, and another male from Kuranda, N. Queensland (*F. P. Dodd, per Janson*).

A medium-sized species with short golden-yellow pubescence on the thorax and on the abdomen, this latter with a reddish-yellow ground-colour. *Antennæ*, palpi, and legs reddish yellow. Frontal callus heart-shaped, reddish brown, very indistinct.

Length, female type 16 mm., the other female 14 mm.; male type 14 mm., others 14–15 mm.

Face reddish brown, but covered with ashy-grey tomentum and with pale yellow short hairs. Beard pale yellow. *Palpi* yellow, only slightly stout at base, ending in a long slender point; pubescence pale yellow or white, consisting of fairly long hairs on the basal part. *Antennæ* Mars-yellow, the first two joints paler, with a few black hairs, the third broad at its base; the tooth represented by an obtuse angle. *Forehead* narrow, parallel, about six times as long as it is broad, covered with much the same coloured tomentum as the face, but the pubescence is brighter-coloured, more orange-yellow, with some black hairs intermixed; the frontal callus is only indicated by a heart-shaped reddish-brown spot, reaching the eyes, but with no lineal extension, it is partially obscured by the pubescence which overlaps it, and

may possibly cover it in very fresh specimens. *Thorax* and *scutellum* blackish, covered with superincumbent golden-yellow pubescence, and longer hairs of the same colour at the sides, on the posterior border of thorax, and on the scutellum; breast covered with tawny tomentum and with some long white hairs. *Abdomen* reddish yellow, with some tawny tomentum and covered with appressed golden-yellow pubescence, with which is intermixed black pubescence of the same nature, apex of abdomen becomes somewhat darker; underside paler-coloured with white pubescence. *Legs* reddish yellow; the tibiae paler yellow; the tarsi dusky; pubescence chiefly black with some white hairs on coxae and on the femora. *Wings* clear; stigma yellowish; veins reddish yellow; appendix very long and curved in the type, but not so long in the other female.

Male is altogether paler in appearance. *Eyes* with the large facets taking up two-thirds of the surface, reaching beyond the apex of the frontal triangle, but not quite reaching the vertex, so that a narrow border of the small facets extends to the vertex. *Thorax* with the pubescence a dirty white colour and much longer; this applies also to the scutellum. *Abdomen* with the same-coloured pubescence on a paler ground-colour. *Legs* rather paler in colour.

A female from S. Queensland (*Dr. T. L. Bancroft*), 1908, 72, has the legs wholly reddish yellow, and the pubescence on thorax and abdomen paler in colour.

XXIII.—*Notes on Degeneration in the Teeth of Oxen and Sheep.* By J. WILFRID JACKSON, F.G.S. (Assistant-Keeper, Manchester Museum).

IN a Report on the Animal Remains discovered at Corstopitum (Corbridge-on-Tyne)* Messrs. A. Meek and R. A. H. Gray call attention to the absence of the first lower premolar tooth in several jaws of oxen found on the site. This form they considered distinct from the domesticated cattle (*Bos taurus*, var. *longifrons*) of Roman and earlier times, and it was accordingly described by them as a new wild species, viz. *Bos sylvestris*. They further state that this species is represented to-day by the Chillingham herd, in which there is apparently a similar absence of the first lower premolar.

* 'Archæol. Æliana,' 3 ser. vii. 1911, pp. 99 *et seq.*

Mr. R. Lydekker, in 'Science Progress,' vol. vi. 1912, p. 556, criticizes the above conclusion, stating, "the alleged absence of the anterior premolar is probably a feature due to domestication."

Amongst almost any collection of oxen-remains from Romano-British stations this five-toothed form is to be found, though it is often passed unnoticed if the jaws happen to be imperfect.

I have met with it on several occasions, and specimens may be seen in the Manchester Museum from the Wirral submerged forest, the peat of Cambridge, alluvium near Castle-ton, Derbyshire, burial mounds, Rudston, Yorks (? Bronze Age), a wolf-den (pre-Sixteenth Century) at Haverbrack, Westmorland, and Dog Holes cave on Warton Crag, Lancs (Romano-British). The Cambridge, Rudston, and Haverbrack examples illustrate the feature in both right and left jaws; the other specimens are odd jaws.

At Dog Holes normal jaws of small oxen were also found at a lower horizon, *i. e.* Neolithic, and on comparing two six-toothed jaws from this cave, one Neolithic and the other Romano-British, it is observed that the relative proportions of the molars and premolars in each jaw are different. While the molars of the later (Romano-British) jaw are only slightly shorter than those in the earlier jaw, the premolars, especially $\overline{\text{pm. 2}}$, show a much greater decrease in length. For example, $\overline{\text{pm. 2}}$ in the Romano-British jaw is more than one-fourth less in length than the same tooth in the Neolithic jaw, while $\overline{\text{m. 1}}$ is only about an eighth less. The annexed table of measurements will show this more clearly:—

	$\overline{\text{Pm. 2.}}$ mm.	$\overline{\text{Pm. 3.}}$ mm.	$\overline{\text{Pm. 4.}}$ mm.	$\overline{\text{M. 1.}}$ mm.	$\overline{\text{M. 2.}}$ mm.	$\overline{\text{M. 3.}}$ mm.
Neolithic	13·3×9·7	19×12·5	21·5×14·3	24·2×15·5	26·3×15·5	37·3×15
Romano-British.	9·8×8	15·7×10·4	19·3×11	21·1×12·6	23·6×13·1	34·4×12
% of decrease . .	·263×·175	·184×·168	·102×·230	·128×·187	·102×·154	·077×·18

It will be noticed that $\overline{\text{pm. 4}}$ does not show this decrease so much in the length as in the breadth.

Having had the opportunity of going through the animal-remains from the Glastonbury Lake Village, preparatory to writing a full report on them in collaboration with Prof. W. Boyd Dawkins, I carefully looked for any trace of the above five-toothed form, and was surprised to find it so much in evidence. The series, moreover, provided specimens of

adult lower jaws showing stages towards a five-toothed condition. Three stages are clearly represented, as follows:— (1) Jaws with $\overline{\text{pm. 2}}$ in place; (2) jaws with $\overline{\text{pm. 2}}$ in place but in process of being pushed out, roots partly absorbed; (3) jaws with $\overline{\text{pm. 2}}$ absent, with slight traces of alveolus remaining. In the six-toothed jaws, *i. e.* where $\overline{\text{pm. 2}}$ is present, that tooth shows very little, or almost no, trace of wear, even though all the remaining teeth, including $\overline{\text{m. 3}}$ and $\overline{\text{pm. 4}}$, are considerably worn. One pair of jaws shows $\overline{\text{pm. 2}}$ in position, but the adjacent premolar is so crowded against it that the $\overline{\text{pm. 2}}$ is only lightly held in its socket, and when lifted out it is seen that its roots are almost absorbed.

The possibility of this being a persistent milk-molar was considered, but on cutting away the bone below the tooth no successional tooth was found nor was any crypt present, the bone being quite compact. The tooth was then carefully compared with another $\overline{\text{pm. 2}}$ and with a deciduous molar ($\overline{\text{m. m. 2}}$), and was found to agree exactly with the former.

The left ramus of another lower jaw illustrates the shedding even better, as the anterior root of $\overline{\text{pm. 2}}$ is visible, it having been pushed through the anterior wall of its alveolus. Both the above examples would belong to animals considerably over three years of age*.

Evidence of the former presence of $\overline{\text{pm. 2}}$ in other adult lower jaws is furnished by partly obliterated alveoli. The youngest jaw showing the five-toothed condition is one in which $\overline{\text{pm. 4}}$ has just begun to wear,

Two of the Glastonbury five-toothed specimens are of further interest, as showing an abnormal condition in the last true molar ($\overline{\text{m. 3}}$). In all true ruminants this tooth is characterized by the addition of a third posterior lobe†. This lobe is very small and simple in the gnu, and relatively larger in the Bovidae and Cervidae. In the Glastonbury specimens the third lobe of $\overline{\text{m. 3}}$ is much less developed than in two specimens of the gnu in the Manchester Museum‡, it being represented by a slight loop only. The same condition is to be seen in the lower jaws of a polled skull of a "wild" white cow supposed to be the last relic of a herd formerly kept at

* Calculated from table in Owen's 'Anatomy of Vertebrates,' vol. iii. 1868, p. 352.

† Tomes, 'Dental Anatomy' (1898, p. 406, footnote), mentions *Neotragus hemprichii*, a small Abyssinian antelope, as having only two lobes to the third lower molar.

‡ In both these specimens of gnu the lower jaws have only five teeth, $\overline{\text{pm. 2}}$ being absent.

Measurements of Teeth of Oxen (in millimetres).

	Pm. 2.	Pm. 3.	Pm. 4.	M. 1.	M. 2.	M. 3.
<i>Six-toothed lower jaws.</i>						
Dog Holes (Rom.-Brit.)	Fallen out.	17.5 × 10.3	19 × 11.1	20 × 12.5	22.5 × 13	35 × 13
Submerged Forest, Wirral ..	Fallen out*.	Fallen out.	20.2 × 12.6	20 × 13.8	23 × 14.3	34 × 15
Ditto	Fallen out*.	Fallen out.	19.1 × 12	21.6 × 14.3	22.5 × 14.6	33 × 14.5
Glastonbury, No. 6	11.3 × 8.8	18.5 × 11.1	20 × 13.2	22 × 14	23 × 15	32 × 15.6
Ditto, No. 2	9 × 8	16.3 × 9.6	15.5 × 12.6	20 × 14	23.5 × 14.3	36.2 × 15
Ditto, No. 20	9 × 7.5	17 × 10.8	20.5 × 12.2	21.5 × 14.5	25 × 15.6	36 × 15
<i>Five-toothed lower jaws.</i>						
Flaverbrack (Cave) .....	.....	19.5 × 10.5	21 × 12.4	24 × 14.3	25 × 14.5	34 × 14
Rudston (Burial mound) .....	.....	18 × 13.3	19 × 14.4	22 × 14.7	25.5 × 17	39.5 × 17.7
Cambridge (Peat) .....	.....	21.2 × 12.3	22.2 × 12.6	24.2 × 15	27.2 × 15.3	40 × 15.6
Glastonbury, No. 14 .....	.....	18.3 × 12	17.3 × 14	20.2 × 14	23 × 15.3	28.5 × 14.8†
Ditto, No. 13 .....	.....	19 × 12	20.2 × 13	21 × 14.8	24 × 15.6	34 × 15.7
Ditto, No. 9 .....	.....	Fallen out.	22.5 × 11.7	24 × 12.6	27.5 × 13.1	33 × 12.6†

* The alveoli of these specimens show that Pm. 2 was being pushed out, as in the Glastonbury described examples.

† Small posterior lobe to this molar.

‡ Teeth very narrow.

Gisburn, Yorks. This specimen is also in the Manchester Museum, and the lower jaws have the usual six teeth.

Comparing a number of five-toothed jaws with a like number of six-toothed jaws, there seems to be a general tendency for all the teeth in the latter form to be somewhat smaller, as will be seen by the table on p. 294.

It might here be mentioned that there is nothing in the Glastonbury bones and lower jaws to indicate that more than the one species is present, viz. *Bos longifrons*.

Unfortunately in most finds the exact relation between the upper and lower teeth cannot usually be ascertained, owing to the scattered and imperfect condition of the remains. It might be of interest, therefore, to point out that the associated upper and lower jaws were found of the Haverbrack specimen, and these show the six teeth of the upper jaw exactly opposed to the five lower teeth; so that, if $\overline{\text{pm. 2}}$ were present, it would be quite functionless.

The whole feature of the loss of $\overline{\text{pm. 2}}$ in some oxen jaws seems to me to be a clear case of degeneration gradually brought about by disuse of that particular tooth.

Though the absence of $\overline{\text{pm. 2}}$ in ox jaws has been known for some time, the absence of this tooth from the jaws of sheep does not appear to have been noted hitherto. On sorting the sheep-remains from Glastonbury, however, I came across a fair percentage of lower jaws with only two premolars and three molars present in place of the usual six teeth.

This feature, as in the ox, may be likewise due to disuse, probably through change of food or habit under domestication.

As a further instance of $\overline{\text{pm. 2}}$ being missing, I might mention that both lower jaws of a specimen of *Capra ibex* in the Manchester Museum possess only five teeth.

XXIV.—*New Species of Heterocera from Dutch New Guinea.*

By J. J. JOICEY, F.L.S., F.E.S., and G. TALBOT, F.E.S.

[Plate XII.]

THE following species were all collected by Messrs. A. C. and F. Pratt in the Arfak Mountains, Dutch New Guinea, and the types are in the collection of Joicey. We are indebted to the Hon. W. Rothschild and Sir Geo. H. Kenrick for the opportunity afforded of comparing specimens in their collections.

Milionia rubrifascia, sp. n. (Pl. XII. fig. 1.)

Allied to *ventralis*, Roths., but at once distinguished by the much narrower band on the fore wing. This band narrows posteriorly and ends at vein 2. On the hind wing the blue basal area is much deeper in colour and has not the greenish reflection of *ventralis*.

Underside of fore wing with band paler and basal blue almost reaching it. Hind wing below with basal blue extending to end of cell and occupying same area as in *ventralis*.

Sexes similar.

Length of fore wing, ♂ ♀, 19 mm.

Types from Angi Lakes, Arfak Mountains, 6000 feet, N. New Guinea, Jan. to March 1914. A series.

Milionia rubra, sp. n. (Pl. XII. fig. 2.)

This species seems nearly allied to *ovata*, Roths., but differs especially in its much smaller size.

♀. *Upperside*.—Fore wing at extreme base, apical area, and outer margin black; rest of wing brick-red. This colour extends along costa to end of cell, then below subcostal to beyond origin of vein 7, and curving round to the inner margin. Base of costa yellow. Hind wing black shot with deep blue, which is much brighter at the base of cellules 2 and 3.

Underside.—Fore wing as above, red colour paler; a black and somewhat oblong patch at base below cell. Hind wing black; the extreme base in cellule 8 metallic blue, adjacent to which is a red spot, which does not touch costa. Head and collar metallic greenish blue; thorax and abdomen black, tinged with dark blue; legs black.

Length of fore wing 19 mm.

Type from Angi Lakes, Arfak Mountains, 6000 feet, N. New Guinea, March 1914. A series of 4 ♀ ♀ only.

Milionia xanthica, sp. n. (Pl. XII. fig. 3.)

♂. *Upperside*.—Fore wing black. An orange-yellow band 2 mm. broad, commencing at inner margin about two-thirds from base and extending into the cell between veins 2 and 3. Base of wing dark blue, shading into the ground-colour as far as the band. Hind wing with costa narrowly black; base black to near end of cell and shot with dark blue; distal area orange-yellow, a black marginal spot at extremity of vein 7, and three black dots at ends of veins 6, 4, and 3.

Underside like the upper. Band on fore wing wider and more clearly defined.

Head and thorax metallic blue above, blackish brown beneath; abdomen blackish brown and tinged with dark blue above.

♀ similar to ♂. Band on fore wing wider and more sharply defined. Basal blue brighter and suffusing the band. Hind wing without the three marginal dots, and below with only a faint dot on the end of vein 7, and costal black not reaching apex.

Length of fore wing, ♂ ♀, 21 mm.

Types from Angi Lakes, Arfak Mountains, 6000 feet, N. New Guinea: ♂ Jan. to Feb. 1914, ♀ March 1914. A series of 2 ♂ ♂ and 13 ♀ ♀ from same locality, Jan. to March 1914.

The following three aberrational forms are contained in the series:—

Milionia xanthica, ab. *nigra*.

This form is represented by a single ♀, and differs in the complete absence of the band on the fore wing above. Below the band is wider than in the typical ♀, but may be much reduced, leading to the following form.

Milionia xanthica, ab. *bipuncta*. (Pl. XII. fig. 4.)

The band on the fore wing is here reduced to two ill-defined spots, one between veins 2 and 3 near their base and a larger one below it. These spots are better defined on the underside.

This specimen shows an increase of black at apex of hind wing, the spot on vein 7 being merged with the costal black.

Type (a ♀) the only specimen.

Milionia xanthica, ab. *extensa*. (Pl. XII. fig. 5.)

The band on the fore wing is much widened distally and extends to upper margin of cell. Its outer edge is ill-defined, and yellow scales are mixed with the ground-colour almost to outer margin, the yellowish tinge extending to vein 5; this is much better defined below. The yellow of the hind wing is more extended on both sides, so that the basal black does not reach beyond middle of cell, and its edge is irregularly defined.

Type (a ♀) the only specimen.

Transitions occur between the above forms. The only other ♂ in the series has the fore-wing band much narrowed and only extending to vein 2. In a ♀ it is still more reduced and only faintly indicated as far as the cell. Another ♀ has the band twice as wide as in the typical form.

Milionia knowlei, sp. n. (Pl. XII. fig. 6.)

♂. *Upperside*.—Fore wing black faintly shot with deep blue. Base metallic greenish blue, with a >-shaped indentation of the ground-colour. Hind wing with basal half to end of cell metallic greenish blue, distal half shot with deep blue.

Underside of fore wing black faintly shot with deep blue. Base metallic greenish blue, extending to near end of cell as far as vein 3. Hind wing black faintly shot with deep blue. At base a metallic greenish-blue costal streak, a similar streak along lower margin of cell on each side of median; a dark blue streak along inner margin. A subapical black patch of short hair or androconia, the hairs of which are directed outwardly.

Head, thorax, and abdomen metallic greenish blue; abdomen black below. Legs metallic greenish blue on outer side.

Sexes similar, ♀ without the hairy patch on hind wing below.

Length of fore wing, ♂ ♀, 22 mm.

Types from Angi Lakes, Arfak Mountains, 6000 feet, N. New Guinea, Jan. to Feb. 1914. A series of ♂ ♂ and 1 ♀.

This species seems nearly allied to *callima*, Roth. & Jord., and which has also the patch of modified scales on the hind wing below. Rothschild and Jordan, in the *Deutsch. Ent. Zeit.* 1907, pp. 194–5, describe a similar structure in *lamprima*, and note that in *euglennia*, a very similar-looking species, it is absent. Several other species of the genus exhibit the same characteristic.

Milionia weiskei rubidifascia, subsp. n. (Pl. XII. fig. 7.)

♂. Differs from *weiskei*, Roth., in the yellow band on fore wing being a little narrower and constricted between vein 2 and submedian. The apex is tipped with yellow, forming a spot. On the hind wing the red proximal bordering of the yellow band is much broader and widens posteriorly. The outer edge of the yellow band is incurved and rounded between veins 7 and 4, then convex to 2, and slightly incurved from thence to anal angle.

♀. Larger than ♂, and differing from *weiskei* ♀ in the red band on hind wing being distally widened and yellow band narrower between veins 4 and 6.

Length of fore wing, ♂ 23, ♀ 27 mm.

Types from Angi Lakes, Arfak Mountains, 6000 feet, N. New Guinea, Jan. to Feb. 1914. The only specimens.

Eubordeta albifascia, sp. n. (Pl. XII. fig. 8.)

♂. *Upperside*.—Fore wing black tinged with deep purplish blue. A narrow white band extends from costa across cell near its end, narrowing between veins 2 and 3 and ending a little below 2; distal edge of band dark glossy blue, as is also the basal half of wing. Hind wing ground-colour as in fore wing, basal half to end of cell a darker blue than on fore wing; costal margin brick-red, widening at the middle.

Underside of fore wing paler, a white band as above. A narrow yellow apical band, widest in the middle, extends from vein 7 to just below 4. Hind wing ground-colour paler than above; costa crimson at base, as is also a spot at base of costal vein; remainder of costa, limited by costal, orange-yellow; this streak joins a narrow marginal yellow band, irregularly shaped and reaching just below 3. A discal band, beginning below origin of vein 7, where it is white, to vein 5, and then yellow, crosses the cell near its end, fills the base of cellule 3, forms a square spot in 2 and a larger and proximally rounded spot in 1*b* and 1*c*.

Head, thorax, and abdomen blackish blue; three lateral crimson spots on abdomen.

Length of fore wing 22 mm.

Type from Angi Lakes, Arfak Mountains, 6000 feet, N. New Guinea, March 1914. A series of 6 ♂♂.

This species, in the markings of the hind wing below, recalls *E. rufoplagata*, Baker.

Craspedopsis angiana, sp. n. (Pl. XII. fig. 9.)

Above black, with a faint blue sheen at apex and outer margin of fore wing and over the dark distal part of hind wing. Both wings at base metallic greenish blue. On fore wing the basal blue extends to near middle of cell and to middle of inner margin, its distal edge straight and at right angles to costa. On hind wing the basal blue extends a little beyond cell, is limited by the costal, and reaches to near anal angle.

Underside of fore wing black, with a white band about 3 mm. wide, extending from subcostal across end of cell to

just beyond vein 2; base metallic greenish blue as far as the band. Hind wing below as above, but the blue extends farther and leaves a narrower distal margin than above.

Head, thorax, and abdomen dark blue.

Sexes similar, except that the ♂ bears on coxa of fore leg a thick fringe of white hair.

Length of fore wing, ♂ 17, ♀ 19 mm.

Types from Angi Lakes, Arfak Mountains, 6000 feet, N. New Guinea, March 1914. A series.

Buzara calodesma latimargo, subsp. n.

(Pl. XII. fig. 10.)

♀. Differs from *calodesma*, Roths., in the extended red at base of costa of fore wing nearly filling the basal two-thirds of cell, leaving only a narrow streak of black at its base. The yellow band is deeper in colour and nearly straight on its outer edge, and is widened proximally to just below origin of vein 2. At apex of wing the fringe only is yellow. On the hind wing the marginal band is about three times as wide as in *calodesma*, being 4 mm. broad. Below, the band on fore wing is broader than above.

Length of fore wing 29 mm.

Type a ♀ from Momi River, N. New Guinea, March 1914. The only specimen.

Parabasis felixi, sp. n. (Pl. XII. fig. 11.)

♂. Ground-colour of whole insect chrome-yellow, veins and other markings chestnut-brown.

Upperside.—Fore wing with only the costa, apical area, and outer margin for a breadth of 4 mm. of the ground-colour, the rest being creamy buff, limited distally by the first of four transverse lines; the first of these begins at a quarter of costa from apex, curves at vein 7, is straight to 4, and lunulate to inner margin at three-quarters from base; the second line parallel to first and much thicker, the third as thick and straighter, the space between it and second being twice the width between this and first line; the fourth line, faint on costa, is marked by a curve in middle of cell, a short bar, more proximal, below median of cell, and a straight line, more distal, from 1c to inner margin, where it joins the second line. Base of cell suffused with chestnut-brown, and a square spot of same colour below it near base. A thick line from base along inner margin and touching fourth line. Interspace between discocellular, third line, and vein 4 suffused with chestnut-brown; the third line joins the second

along vein 4. Outer margin with an irregular band from costa to vein 3, and separated from first discal line from costa to vein 6 by a yellowish line with black dots proximally of it on veins 6, 7, and 8. A submarginal row of seven black spots and a dot in cellule 8 at apex. Fringes dark at ends of veins. Hind wing without markings, except a black spot at anal angle and a small tuft of black hair below it.

Underside.—Fore wing chrome-yellow, darker beyond cell and over apical third; three black dots, the first the largest, in cellules 7, 6, and 5. Hind wing without markings.

Antennæ with black dot at base on vertex, prothorax, and patagia marked with chestnut-brown, the latter with fringe tipped with black; a small tuft of black hair at base of abdomen; tarsi black.

♀. Similar to ♂, with paler brownish markings and discal lines more heavily marked.

Length of fore wings, ♂ ♀, 27 mm.

Types from Angi Lakes, Arfak Mountains, 6000 feet, N. New Guinea, Jan. to Feb. 1914. 2 ♂ ♂ and 1 ♀ were obtained.

EXPLANATION OF PLATE XII.

- Fig. 1. Milionia rubrifascia*, ♀.
Fig. 2. — rubra, ♀.
Fig. 3. — xanthica, ♀.
Fig. 4. — —, ab. *bipuncta*.
Fig. 5. — —, ab. *extensa*.
Fig. 6. — knowlei, ♂.
Fig. 7. — weiskei rubidifascia, ♂.
Fig. 8. Eubordeta albifascia, ♂.
Fig. 9. Craspedopsis angiana, ♂.
Fig. 10. Buzara calodesma latimargo, ♀.
Fig. 11. Parabasis felixi, ♂.

XXV.—Upper Silurian Foraminifera of Gothland.

By JOHN SMITH.

[Plate XIII.]

PREVIOUS KNOWLEDGE OF THE PALÆOZOIC FORAMINIFERA.

WE are pretty well acquainted with the Carboniferous Foraminifera, so well depicted in Brady's "Monograph," published by the Palæontographical Society in vol. xxx.

In strata lower than the Carboniferous few species have hitherto been found.

In quartzites etc. of pre-Cambrian age in Brittany very minute things have been got, globular or nearly so, spiny and perforated, sometimes in strings, the largest only the $2\frac{1}{100}$ of an inch in diameter (Ann. Soc. Géol. Nord, vol. xxii.).

Ehrenberg, in 1858, figured five genera from the blue clay of the Baltic provinces, a horizon now known to belong to the Lower Cambrian. They are glauconite casts referable to the genera *Nodosaria*, *Rotalina*, and *Pulvinulina*.

Foraminifera have been recorded from the Cambrian system of Siberia (Q. J. G. S. vol. lvi.) and from the Saint John Series of New Brunswick (Tr. N. Y. Acad. of Sci. vol. xii. for 1893).

In the Q. J. G. S. for 1900 Chapman has figured and described nine species of Foraminifera from the Upper Cambrian in the Malverns. They have all been drawn from polished specimens of the rock, and comprise the genera *Spirillina*, *Lagena*, *Nodosaria*, *Marginulina*, and *Cristellaria*. Chapman, in this paper, says:—"Foraminifera are, however, rare at the best until the lower limestones of the Carboniferous period are reached."

Above the Bala Limestone of Guildfield, near Welshpool, Foraminifera have been got (Geol. Mag. 1882).

Chapman, in his 'Foraminifera,' p. 254, says that in the Llandovery beds of Cwm Symlog *Dentalina*, *Textularia*, and *Rotalia*? have been got, and, at p. 255, *Hyperammina* and *Stacheia* were got in Gotland; he also adds that Vine's Silurian genus *Psammosiphon* has been relegated to the genus *Stacheia*.

Brady, in 1888, figured four species of *Lagena* from the Upper Silurian of England, and I supplied him with some of the specimens (Geol. Mag. for 1888).

Four species have been got in the Upper Silurians of Indiana, and casts from the Devonian of Paffrath, referable to the genera *Lagenulina*, *Cristellaria*, *Orbulina*, *Globigerina*, and *Fusulina*.

GOTHLAND UPPER SILURIAN FORAMINIFERA.

To the casual visitor to Gothland the rocks present but two petrographical series—a great limestone-bed, and under it a rather thicker shale-bed with limey bands and nodules more or less through it, the whole being contained within 240 feet of thickness. In the south of the island there is sandstone under a thick limestone, and on this point there is a division of opinion, the minority, following Murchison, holding the notion that there is an ascending series towards

the south, so that the limestone of Hoburgen—the extreme southern part—is on a higher horizon than that of the rest of the island, and the majority that the sandstone simply occupies so much of the space taken up by the shale in the north. As opinions are not evidence, the proof, one way or the other, will not be obtained till a bore is put down on the Hoburg shore.

The Foraminifera recorded in this paper were obtained, one species from the lower part of the limestone, and the rest from the shales towards their upper part.

HORIZONS.

The Gothland strata range from the *Monograptus*-shales (under the Llandovery) to the Downtonian (above the Ludlow *).

The species got in the limestone may be referred to the Aymestry, and the rest to the Wenlock horizon of England.

FORAMINIFERA (REMARKS ON THE SPECIES).

All the specimens figured are from plump and solid individuals, none from cut sections of the rock, and, unless otherwise stated, are enlarged 40 diameters.

To Mr. Joseph Wright, F.G.S., of Belfast, who has devoted a large part of his lifetime to the study of the Foraminifera, I am indebted for piloting me through this labyrinth of small things. I make this early reference to him, as I will have frequently to bring in his name in connection with some of the species. I am also indebted to him for many of the references.

Hyperammina vagans, Brady.

Girvanella problematica, N. & E.

At the time (1878) Nicholson and Ederidge published their first fasciculus of the Girvan fossils, they gave an excerpt of a letter from Brady, this letter pointing out that *G. problematica* resembled *H. vagans*, a present-day species, and this has been sustained by later investigators. "*Girvanella*" is common in Gothland, so much so that two series of strata have been called "*Girvanella*-zones." This fossil has, however, to be mostly determined from cut bits of the rock; but from the shales I got a number of specimens showing the

* Dr. Munthe's Memoir on the Strata of Southern Gothland (in English).

entire tubes twisting in every direction. The illustration I give is a portion of a small mass, and would have been more complete but for the shale, which more or less covers the tubes.

Loc. Muldé and Fröjel.

Hyperammia minutissima, sp. n.

From its minute size and rough surface, Mr. Wright thinks this form may be made a new species. This little fossil is attached to a spicule, the figure showing about a third of it magnified 1000 diameters.

Loc. Wisby Cement Works.

Hyperammia rectangula, sp. n.

This is also a branching form, and the two figures will show how the branches go off at nearly right angles. Both figures show the primordial cell (also seen in living specimens of *H. vagans*), one of them with a ring. The dimensions are given in Explanation of Plate (p. 309).

Loc. Muldé and Fröjel.

From the Gothland shales I have obtained a series of *Hyperammia*, ranging in size between the largest and smallest species given above, and several "species" might easily be made from them; but as they are smooth and follow more or less the character of *H. vagans*, they may be placed with that species.

Hyperammia ramosissima, Chap.

The figure will show the branching-habit of this species, a feature from which it takes its specific name.

Loc. Gothem.

Reopla pilulifera, Brady.

The specimen is probably incomplete, shows three loculi-ments with very distinct perforations.

Loc. Korpklint.

Reopla adunca, Brady.

This is a rare species.

Loc. Sleté.

Haplophragmium latidorsatum, Born, sp.

Loc. Gothem.

Ammodiscus gordialis, J. & P., sp.

Only one specimen got.

Loc. Korpklint.

Trochammina anceps, Brady.

There was only one got, and it occurred in decayed crystalline limestone.

Loc. Kappelshamn, near the shore.

Webbina cf. *hemispherica*, J., P., & B.

This species is constantly attached to shells etc., but, being uniformly of a brownish colour, I thought it might be a macrospore. Dr. Kidston, however, will not express an opinion on it. Mr. Wright thinks it may be a *Webbina* flattened by pressure. I had never any doubt about the flattening. In appearance it is either a flat cake or like a shallow saucer with a slightly raised rim.

Loc. Rölfvar Liljas hålo and Sleté.

Webbina gothemensis, sp. n.

Occurs as a thin-edged cake on other fossils, the surface swelling up irregularly as shown on figure.

Loc. Gothem.

Stacheia acervalis, Brady.

Not abundant, but pretty widely spread and attached to other organisms, and on account of this differs greatly in appearance.

Loc. Stora Carlsö, Muldé, and Lau Canal. Common in the Carboniferous rocks of Scotland.

Stacheia congesta, Brady.

The two figures will show the extreme variations of shape.

Loc. Muldé, Fröjel, Wisby Cement Works, Lummelunds Bruk. Common in the Carboniferous limestones and shales of Scotland.

Lagena globosa, Montag., sp.

This species differs greatly in size and shape, sometimes all but globular, others long-oval, and in cross-section not always round. They can be distinguished by their colour, a light grey. The five illustrations are each from different specimens :

a, view of aperture; *b*, *c*, undersides. Some of the shapes are identical to those assumed by the little freshwater Rhizopod of our ponds and ditches called *Diffugia*.

Loc. Lau Canal, Sluguklint, Korpklint, Stora Carlsö.

Lagena lævis, Montag., sp.

The two figures give the extreme variation in shape seen.

Loc. Lau Canal and Sluguklint.

Lagena clavata, D'Orb., sp.

The two figures show the extreme of variation.

Loc. Sluguklint.

Lagena gracillima, Seg., sp.

The two figures show considerable differences in shape, but not any more so than recent forms.

Loc. Wisby Cement Works.

Lagena parkeriana, Brady.

The seven figures I give of this species will show how it varies in shape and size.

Loc. Stora Carlsö, Lau Canal, Rölfvar Liljas hälo, and Sluguklint. Common in the Carboniferous limestones of Scotland.

Lagena auriculata, var. *linearituba*, Cushman.

I had regarded this form as a *Fusulina*, but Mr. Wright has no doubt of its being a *Lagena*.

Loc. Wisby Cement Works.

Lagena cylindrica, sp. n.

This species is all but cylindrical, with the neck of the tube sometimes slightly bent.

Loc. Stora Carlsö and Wisby Cement Works.

Lagena gottlandica, sp. n.

Globular, with a short tube.

This form differs from all recorded species of Foraminifera in having minute concentric striæ, resolvable by high powers into beaded lines running round the test. As wasted specimens it is not infrequent, but when perfect it is a bright glittering little form.

Loc. Stora Carlsö.

Lagena gutta *, sp. n.

Like the above, this one has got surrounding striæ, but differs in being oval and apiculate.

Loc. Fröjel.

Lagena storavedensis, sp. n.

Like the two last, this one has also got striæ running round the shell. In shape it comes pretty near to some of the forms of *L. parkeriana*.

Loc. Stora Vedé.

Lagena visbeyensis, sp. n.

This form is apiculate, with a long tube, and has got four to six strongly pronounced rounded costæ.

Loc. Wisby Cement Works.

Lagena acutangula, sp. n.

This one has got a strong resemblance to *L. gracillima*, but has five sharp-edged costæ.

Loc. Wisby Cement Works.

Nodosaria cf. soluta, Rss.

The figure in the 'Challenger' Monograph has seven luculiments; the one figured here has only three, but is probably imperfect.

Loc. Stora Vedé.

Nodosaria inflexa, Rss., sp.

The two figures will show the extreme varieties of shape.

Loc. Wisby Cement Works and Sluguklint.

Nodosaria siluriana, sp. n.

Resembles *N. inops*, Rss., but differs in having sharp costæ with deep spaces between them.

Loc. Wisby Cement Works.

Orbulina universa, D'Orb.

This is not a common form in the Gothland shales, but its minute size may cause it to be overlooked.

Loc. Stora Carlsö.

* Gutta was the poetical name of Odin.

GOTHLAND UPPER SILURIAN FORAMINIFERA, SHOWING
THEIR RANGE IN TIME.

	Cambrian.	Upper Silurian, Gothland.	Carboniferous.	Recent.
<i>Hyperammina vagans</i> , <i>Brady</i>	*	*	*
— <i>minutissima</i> , sp. n.	*		
— <i>rectangula</i> , sp. n.	*		
— <i>ramosissima</i> , <i>Chap.</i>	*		
<i>Reoplax pilulifera</i> , <i>Brady</i>	*	*	..	*
— <i>adunca</i> , <i>Brady</i>	*	*	..	*
<i>Haplophragmium latidorsatum</i> , <i>Born.</i> , sp.	*	*	..	*
<i>Ammodiscus gordialis</i> , <i>J. & P.</i> , sp.	*	*	*	*
<i>Trochammina anceps</i> , <i>Brady</i>	*	*	
<i>Webbina hemisphærica</i> , <i>J., P., & B.</i>	*	*	..	*
— <i>gothemensis</i> , sp. n.	*		
<i>Stacheia acervalis</i> , <i>Brady</i>	*	*	
— <i>congesta</i> , <i>Brady</i>	*	*	
<i>Lagena globosa</i> , <i>Montag.</i> , sp.	*	*	*	*
— <i>lævis</i> , <i>Montag.</i> , sp.	*	*	*	*
— <i>clavata</i> , <i>Montag.</i> , sp.	*	*	*	*
— <i>gracillima</i> , <i>Seg.</i> , sp.	*	..	*	*
— <i>parkeriana</i> , <i>Brady</i>	*	*	
— <i>auriculata</i> , var. <i>linearituba</i> , <i>Cushman</i>	*	..	*
— <i>cylindrica</i> , sp. n.	*		
— <i>gottlandica</i> , sp. n.	*		
— <i>gutta</i> , sp. n.	*		
— <i>storavedensis</i> , sp. n.	*		
— <i>visbyensis</i> , sp. n.	*		
— <i>acutangula</i> , sp. n.	*		
<i>Nodosaria cf. soluta</i> , <i>Rss.</i> , sp.	*	*	..	*
— <i>inflexa</i> , <i>Rss.</i> , sp.	*	*	..	*
— <i>siluriana</i> , sp. n.	*		
<i>Orbulina universa</i> , <i>D'Orb.</i>	*	..	*

Abstract.

Recent	13 species.
Carboniferous	8 "
Upper Silurian	29 "
Cambrian	11 "

The whole of the Cambrian species are got living at the present day.

New species, ten. Species hitherto known from the Upper Silurian, seven.

EXPLANATION OF PLATE XIII.

Figures enlarged 40 diameters, unless otherwise stated.

Hyperammina vagans, Brady, $\frac{83}{1}$, $\frac{60}{3}$ showing primordial cell; tubes at smallest .004 mm. diam., $\frac{85}{1}$. Ring round primordial cell .04 mm. diam., smallest tubes .005 mm., largest .01 to .03 mm. diam.

Hyperammina minutissima, sp. n., $\times 1000$, $\frac{3}{11}$.

Hyperammina ramosissima, Chap., $\times 20$, $\frac{184}{2}$.

Reoplax pilulifera, Brady, $\frac{102}{2}$.

Reoplax adunca, Brady, $\frac{215}{10}$.

Haplophragmium latidorsatum, Born., sp., $\frac{184}{4}$.

Anmodiscus gordialis, J. & P., sp., $\frac{213}{1}$.

Trochammina anceps, Brady, $\frac{102}{1}$, $\times 20$.

Webbina hemisphaerica, J. & P., $\frac{43}{2}$.

Webbina gothemensis, sp. n., $\frac{293}{1}$.

Stacheia acervalis, Brady, $\frac{82}{3} \times 10$, $\frac{274}{2} \times 8$.

Stacheia congesta, Brady, $\frac{82}{2} \times 10$.

Lagena globosa, Montag., sp., $\frac{165}{10}$.

Lagena laevis, Montag., sp., $\frac{163}{2}$.

Lagena clavata, Montag., sp., $\frac{3}{6}$.

Lagena gracillima, Seg., sp., $\frac{3}{6}$ c, $\frac{131}{3}$.

Lagena parkeriana, Brady, $\frac{3}{8}$, $\frac{103}{5}$, $\frac{102}{5}$, $\frac{131}{2}$ a, b, c.

Lagena auriculata, var. *linearituba*, Cush., $\frac{291}{1}$.

Lagena cylindrica, sp. n., $\frac{3}{8}$ a.

Lagena gottlandica, sp. n., $\frac{269}{12}$.

Lagena gutta, sp. n., $\frac{59}{4}$.

Lagena storavedensis, sp. n., $\frac{131}{2}$.

Lagena visbyensis, sp. n., $\frac{3}{7}$: a, top view.

Lagena acutangula, sp. n., $\frac{3}{7}$ c : d, top view.

Nodosaria cf. *soluta*, Rss., sp., $\frac{131}{9}$.

Nodosarius inflexa, Rss., $\frac{19}{3}$.

Nodosaria siluriana, sp. n., $\frac{3}{5}$.

Orbulina universa, D'Orb., $\frac{262}{14}$.

XXVI.—*The Holotype of Ammothera carolinensis, Leach*
(*Pycnogonida*). By W. T. CALMAN, D.Sc.

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JUST a century ago, in the first volume of his 'Zoological Miscellany' (pp. 33-34, pl. xiii.)*, Dr. W. E. Leach described and figured a new species of Pycnogonid, which he placed in a new genus under the name *Ammothera carolinensis*. Loman† has pointed out that, according to the original description and figure, Leach's species is not congeneric with the majority of species that have since been referred to *Ammothera*, but belongs to the group to which the name *Leionymphon*, Möbius‡, has been given. This conclusion has been accepted, and the consequent changes in nomenclature have been made, by Bouvier and by Hodgson.

One of the two specimens described by Leach is preserved in the British Museum and, although not quite unscathed by the accidents of a hundred years, it is still in fair condition. As Loman's discussion is based solely on Leach's description and figure§, it seems desirable to place on record some further details regarding this specimen, which must now be accepted as the holotype of the species.

Description.—The specimen is immature, as is shown by the chelate condition of the chelophores and the shortness of the ovigers. The body appears to be somewhat shortened by contraction in drying.

Lateral processes separated by intervals of less than half their diameter, each with a slight distal ridge which is very indistinctly bilobed.

Transverse body-ridges very prominent, rising into acutely conical median processes with the points directed obliquely forwards.

Cephalon about twice as wide as long. *Ocular tubercle*

* Hoek ('Challenger' Rep. Pycnogonida, p. 23, 1881) gives the date as 1815, but Mr. C. D. Sherborn assures me that there is no reason for doubting the date 1814 given on Leach's titlepage.

† Pantopoden d. Siboga-Exp. p. 10 (1908).

‡ Pantopoden d. deutschen Tiefsee-Exp. p. 183 (1902).

§ It is not correct to state, as Hodgson does (Ann. & Mag. Nat. Hist. (8) xv. p. 146, 1915), that "Loman has called attention to the type-specimen of Leach now preserved in the British Museum." Loman makes no reference to the specimen, and I am not aware that he took any steps to discover whether it still existed.

not quite as tall as the first dorsal process, subcylindrical, with a conical apex; eyes distinct, pigmented, the anterior pair the larger.

Abdomen horizontal, laterally compressed towards the tip, with a distinct basal tubercle, its length one-third of the distance from its base to the front.

Proboscis as long as trunk and abdomen together, with a faint constriction at less than one-third of its length from the base, the distal portion rounded-trihedral in section, narrowing slightly to the broadly truncate tip.

Chelophores extending to one-third of length of proboscis, scape a little longer than chela, fingers strongly arched, much longer than the palm.

Palps (only seven out of the nine segments shown in Leach's figure are preserved) slender, second segment one-half as long as fourth, the three following subequal.

Ovigera with ten segments distinct.

Legs. First coxa a little shorter than third and more than half as long as second. Femur equal to first tibia and four-fifths as long as second. Tarsus and propodus together nearly half as long as second tibia. Propodus slightly curved, with two or three large spines on the proximal part and one smaller near the distal end of the inner edge. Claw about half as long as propodus; auxiliaries five-eighths as long as main claw.

The dorsal surface of the body and the whole surface of the appendages closely set with minute spinules. On the legs, the spinules show here and there a tendency towards arrangement in longitudinal series, but they are not divided into definite bands by sharply marked bare spaces.

Measurements * in millimetres:—

Length of proboscis	10.5
Greatest diameter of proboscis	3.44
Length of cephalon	2.4
Width of cephalon	3.68
Length of trunk	7.84
Width between first and second lateral processes..	2.56
Width across second lateral processes	7.44
Length of abdomen	2.56
Third right leg:—	
First coxa	2.0
Second coxa	3.6

* Besides the usual sources of inaccuracy in the measurements and drawings here given, allowance must be made for the difficulty of handling the very fragile specimen.

Third right leg (*cont.*):—

Third coxa	2·4
Femur	8·0
First tibia	8·0
Second tibia	9·84
Tarsus and propodus	4·8
Claw	1·92
Auxiliaries	1·2

Palp:—

Second segment	2·88
Third „	1·2
Fourth „	5·76
Fifth „	1·04
Sixth „	1·12
Seventh „	1·12

Locality.—Leach says, “For this singular species I am indebted to Mr. Latham of Compton Street, who received two specimens from South Carolina, which were caught on an anchor that had been recently drawn from the bottom of the sea.”

Nothing resembling Leach's type has been found in the North Atlantic during the century that has elapsed since he described it, all the known species that are congeneric with it coming, without exception, from the Antarctic seas. It seems not unreasonable, therefore, to suppose that Leach or his informant may have been mistaken as to the origin of the specimens, and it is a tempting suggestion that “South Carolina” was written instead of “South Georgia.” There is nothing improbable in the supposition that the specimens may have come from the last-named locality, which was much frequented by British and American sealing-vessels during the first two decades of the nineteenth century*. On the other hand, the Museum records afford no information on the point, and our scanty knowledge of the distribution of Pycnogonida does not give much confidence as to what genera may, or may not, be expected in the North Atlantic. Bouvier's recent discovery of a species of *Pentapycnon* on the coast of Guiana is a reminder of the risk of dogmatizing on the subject. Nevertheless, until some evidence is produced that a species resembling that described by Leach does occur in the North Atlantic, it is, I think, justifiable to disregard his statement as to its origin in considering its affinities.

Affinities.—On comparing the characters of the specimen as described above with Bouvier's key† to the species of

* See Weddell, *Voy. South Pole* (London, 1825), p. 53.

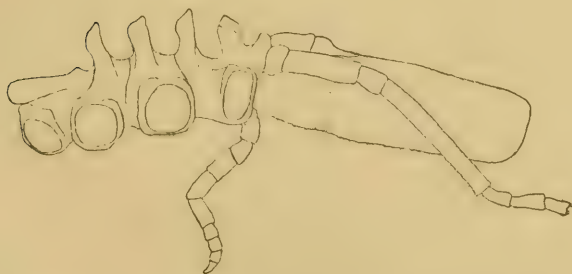
† *Deuxième Expéd. Antarctique Française 1908-1910, Pycnogonides du ‘Pourquoi Pas ?,’* p. 123 (1913).

Fig. 1.



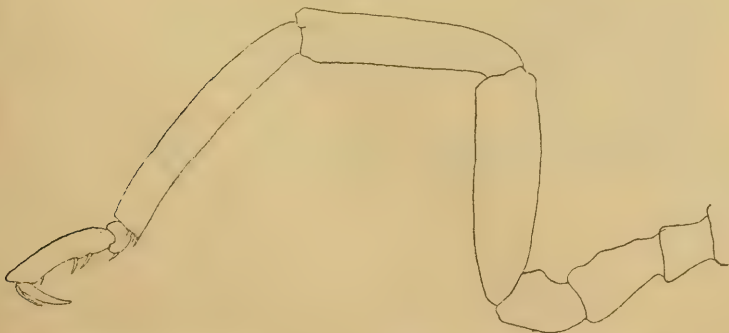
Ammothea carolinensis, Leach, holotype, dorsal view.
Legs and distal portion of palps omitted.

Fig. 2.



Ammothea carolinensis, Leach, holotype, from right side.
Legs omitted.

Fig. 3.



Ammothea carolinensis, Leach, holotype, third leg of right side.
The spinules on the surface of the limb are not indicated.

Ammothea, it is clear that, as Bouvier himself has suggested, Leach's species finds its place near *A. grandis*, Pfeffer, and *A. gibbosa* (Möbius). The difference between these two species is not very great, and Bouvier even suggests that they might be united, but, taking the characters as he gives them, the comparatively short and horizontal abdomen, the inconspicuous tuberosities on the lateral processes, and, above all, the more numerous and closely-set spinules, not arranged in bands, on the legs, are points in which the present specimen agrees rather with *A. grandis*. A closer comparison is hindered by the fact that, while the characters of both species are known to change very considerably with growth, no detailed description of immature specimens of *A. grandis* has been published. There are, in the Museum collection, three specimens that I believe to belong to the last-named species. One of these is immature, with chelate chelophores, but it is much smaller than Leach's holotype and it is in such bad condition as to be of little use for comparison. Assuming, however, that such characters as the relative shortness and stoutness of the legs and greater length of the propodus are due to immaturity, while the shortness of the trunk is caused by shrinkage in drying, I am unable to point to a single definite character by which Leach's specimen can be differentiated from Pfeffer's species. Until it is possible to compare the type-specimens of the two species side by side (which is unlikely to be for some time), I propose that the species should be united, with the following synonymy:—

Ammothea carolinensis, Leach.

- Ammothea carolinensis*, Leach, Zool. Miscellany, i. p. 34, pl. xiii. (1814).
Nymphum carolinensis, H. Milne-Edwards, Hist. Nat. Crust. iii. p. 534 (1840).
Ammothea grandis, Pfeffer, Jahrb. Hamburg. Wiss. Anst. vi. (2) p. 43 (1889).
Colossendeis (?) *charcoti*, Bouvier, Bull. Mus. Hist. Nat. Paris, xi. p. 296 (1905).
Leionymphon grande, Hodgson, Nat. Antarct. Exped. 'Discovery,' Zool. iii. p. 41, pl. vi. fig. 1 (1907); Bouvier, Expéd. Antarctique Française 1903-1905, Pycnogonides du 'Français,' p. 60, figs. 40-43 (1907).
Ammothea grandis, Bouvier, Deuxième Expéd. Antarctique Française 1908-1910, Pycnogonides du 'Pourquoi Pas?', p. 126 (1913).

XXVII.—*Brief Descriptions of new Thysanoptera.*—V.

By RICHARD S. BAGNALL, F.L.S., F.E.S.

Suborder TEREBRANTIA.

Family Æolothripidæ.

Subfamily MELANOTHRIPINÆ.

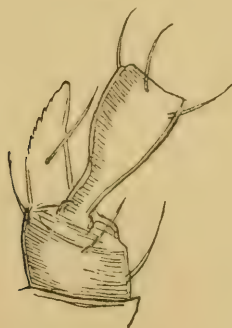
Melanothrips fuscus (Sulzer).

TUNIS: Tunis, 56 ♀♀ and 2 ♂♂, Feb. 7th, and 1 ♀, Feb. 20th, 1903; Sousa, 2 ♀♀ and 1 ♂, Feb. 28th, 1903 (*Biro*). In the National Hungarian Museum.

Genus CRANOTHRIPS, nov.

Apex of the first antennal segment strongly produced inwardly, with the inner edge of the produced part serrate.

Fig. 1.



Cranothrips poultoni. First and second joints of right antenna.

Head broader than long; a long stout genal spine behind each eye and inter-ocular and postocular bristles present.

Fore-wings with cross-veins.

Type. *Cranothrips poultoni*, m.

The genus comes very near *Ankothrips*, and is easily recognized by the structure of the first antennal joint and the simple second joint.

Cranothrips poultoni, sp. n.

♀.—Length 1·65, breadth of mesothorax 0·25 mm.

Colour grey-brown; fore-legs yellow-brown; antennæ with the produced part of first joint clear yellow, joint 3 yellow tinged with grey, and 4 yellowish-brown. Fore-wings light grey-brown, with the first and third fourths white.

Head broader than long, broadest near base. Eyes large, somewhat coarsely faceted, pilose, occupying at least 0·5 the length of the head. A long stout genal spine behind each eye; inter-ocellar and postocular spines rather long. Mouth-cone reaching across prosternum; maxillary palpi long, apical joint shorter and narrower than either joints 1 or 2. Antennæ more than twice as long as head, first joint with the characteristic prolongation described in the generic diagnosis, which almost reaches the apex of the second joint. Relative lengths of joints 3-9 as follows:—19 : 17 : 16 : 15 : 9 : 6 : 8.

Prothorax about as long as the head and 1·75 times as broad as long; furnished with several stout setæ, of which the mid-lateral pair, two at each hind angle, and certain of the postero-marginal series are the longest.

Legs typical of the family; femora and tibiæ sparingly setose. Pterothorax large, 1·25 times longer than broad, sides rounded, giving an oviform appearance.

Wings broad, reaching to the seventh abdominal segment. Fore-wings broadest near middle, where they are nearly 0·2 (one-fifth) as broad as long; both longitudinal veins set with, roughly, 20-22 longish black spines, and costa with about 36. Cilia on lower edge wavy.

Abdomen elongate-ovate, tenth segment shorter than ninth, setæ on 9 and 10 about as long as segment 9.

Hab. Western Australia, near Fremantle, on flowers (nos. 17 and 22). The only named flower is a proteaceous shrub (*Dryandra floribunda*, R. Br.), and it is impossible to say whether this species is attached to *Dryandra* (or any other flower) or is a general species.

I find particular pleasure in naming the species after Prof. E. B. Poulton, F.R.S., who obtained several other interesting species on the occasion of the recent British Association visit to Australia, and who has encouraged my researches in many directions.

Subfamily *ÆOLOTHRIPINÆ*.*Æolothrips fasciatus* (L.).

TUNIS: numerous specimens collected by Mr. Biro in 1903, as follows:—Tunis, 5 ♀ ♀ and 1 ♂, Feb. 7th, and 4 ♀ ♀, Feb. 26th; Sousse, 1 ♂ and 1 ♀, March 28th; Gafsa, 26 ♀ ♀ and 5 ♂ ♂, March 24th, and Gafsa Oasis, 1 ♀, March 25th. National Hungarian Museum.

CANARY ISLANDS: Las Palmas, Grand Canary, 1 ♀ on *Sisymbrium officinale*, June 28, 1914 (*Prof. E. B. Poulton*).

Æolothrips brevicornis, sp. n.

♀.—Length 1.25 mm.

Reddish- to chestnut-brown; fore-legs and third antennal joint yellowish-brown.

This species comes in the "*fasciatus*" group with banded wings, and differs from all the species excepting *fasciatus* in having the abdomen unicolorous. Apart from its small size, *brevicornis* may be separated from *fasciatus* by its shorter antennæ, which are approximately 2.2 times (instead of about 3 times, in *fasciatus*) the length of the head. The intermediate antennal joints are relatively shorter compared with their breadth; joints 3 and 4 are practically subequal, whereas in *fasciatus* joint 3 is 1.2 times the length of 4. In the species of the "*fasciatus*" group in which the base of the abdomen is banded with white the last four (6 to 9) antennal joints are together much longer than the fifth; in *fasciatus* they are practically equal to the fifth (20 : 19), whilst in *brevicornis* they are much shorter than the fifth (19 : 14).

Hab. SOUTH AFRICA: Cape Town, 1 ♀ shaken from a flower, July 13th, 1914 (*Prof. E. B. Poulton*).

Family Thripidæ.

Heliothrips femoralis, Reut.

GERMAN EAST AFRICA: Arusha, 1 ♀ in the collection made by Mr. C. Katona in October and November 1905. National Hungarian Museum.

The species is generally regarded as a hothouse one, but I also have an example taken with *H. hæmorrhoidalis* on banana-palm, Spain.

Heliothrips brunneipennis, sp. n.

Length about 1·5 mm., linear.

Colour dark brown ; head yellowish-brown and abdomen apically lighter. Fore-femora and tibia yellow, lightly tinged with brown ; intermediate and hind femora and tibiæ dark brown, basally yellow, the tibiæ also yellowish-white distally ; all tarsi whitish-yellow. Fore-wings brown, darkest at base, a light patch in about the third tenth ; hind wings light greyish-brown, with median vein darker ; cilia dark. Antennæ with basal joint yellowish ; 2 brown, 3 to 5 clear lemon-yellow, 6 brown, and style yellowish-white.

Head more than 1·8 times as broad at broadest (near base) as long. Cheeks swollen behind eyes, subparallel to a collar-like thickening before constriction at base, which runs in an arc close to the hind margin of the eyes ; reticulations behind collar larger, but not so strong. Eyes large, coarsely faceted, and weakly setose. Ocelli large, posterior pair on a line through middle of eyes. Maxillary palpi 2-segmented. Antennæ at least twice as long as the head, lengths of joints 3 to 8 relatively 26 : 26 : 18 : 10 : 3 : 10,—3 and 4 spindle-shaped, 5 claviform, and 6 globular ; style bristle-like. Forked trichomes on 3 and 4 curved, exceptionally long and slender, one of the arms on 4 being 1·7 times the length of that joint.

Prothorax broader than long, posterior margin from about centre of lateral margins arcuate. Pterothorax large and broad, and about as long as broad. Wings reaching to middle of abdominal segment 8. Fore-wing about 15 times as long as broad through middle, not upcurved distally. Setæ rather short and slender, dark ; costa with 25/26, increasing in length towards apex of wing ; upper vein with 4 near fork and 2 near apex, and lower vein with 1 + 2 + 1 + 1 + 1, the last situated towards the end of the fourth fifth—that is, before the first of the two distal bristles of the upper vein.

Abdomen elongate-ovate, occupying about 0·6 the total length of insect, not broader than the pterothorax. Segments 8 to 10 evenly narrowed to tip ; 9 about 1·8 times as long as 10 ; bristles on 8–10 moderately long, pale.

Hab. Ceylon, Peradeniya, feeding on the leaves of *Litsea chinensis* (A. Rutherford, no. 3648, Ent. Research Comm. no. 60).

Dinurothrips rutherfordi, sp. n.

♀.—Length about 1.1 mm.

Dorsal surface deeply reticulated.

Yellow, shaded with reddish- to chestnut-brown, deepest towards sides of head, thorax, and abdomen. Fore-tibiae yellow, femora brownish; intermediate femora and tibiae brown, yellowish distally; hind-femora greyish-brown, tibiae yellow. Antennae much as in *D. hookeri*, Hood, yellow, second joint deeper in shade, greyish-brown apically. Forewings greyish, yellow in line of veins, with an indistinct brownish band near base and across the seventh eighth, and other scarcely defined bands; setae stout, dark brown basally to yellow (in some) at points; hind-wing with brown median vein.

Head about twice as wide across eyes as long, longer than the prothorax. Cheeks roundly narrowed posteriorly and constricted abruptly at base; explanate, the shelf-like margins projecting somewhat distally in the curve of the outer posterior margin of the eye. Eyes prominent, occupying about 0.5 the length of the head, coarsely faceted and not pilose; space between them almost twice the width of the eye. Ocelli and antennae almost as in *D. hookeri*. Vertex also with shelf-like margin. Maxillary palpi apparently 2-jointed.

Prothorax with broad, wing-like, explanate, lateral margins, anteriorly wider and more broadly rounded than posteriorly. Pronotum proper transverse, not as broad as the head, with a series of lateral and antero-marginal setae in pairs, and a pair of pre-basal ones, one on each side of the median line.

Pterothorax massive, twice as broad as the pronotum proper (*i. e.* excluding the explanate margins); metanotum narrower than the mesonotum, the latter sharply narrowed to juncture with abdomen, which is waist-like. Wings reaching to abdominal segment 8, slender and linear; forewings not upwardly curved distally, veins running close to margins; setae on costa stout and widely spaced, only 8 or 9; those on veins both longer and stouter; upper vein with 2 near base, 1+1 in second fourth and 1+1+1 in distal third; lower vein with 8 setae, 2 near base and then 1+1+3+1. Top fringe somewhat sparse, lower long and wavy.

Abdomen elongate, slightly broader than the pterothorax; surface of each segment anteriorly and laterally deeply reticulated; ninth partially received into eighth; tenth

cylindrical, divided dorsally, about 0.7 the length of head and 0.5 the length of segment 9. Bristles on 9 only about 0.7 the length of 10; a stoutish bristle on each side of the longitudinal division of segment 10 near apex, 0.8 the length of the segment.

Larvæ yellow; head, pronotal plates, and last two abdominal segments dark greyish-brown; legs dirty greyish-yellow to brown.

Type. British Museum of Natural History.

Hab. Ceylon, Peradeniya, on leaves of *Allamanda*, 20. 2. 14, *A. Rutherford* (A. R. no. 3673, Ent. Res. Comm. no. 61), also 27. 3. 14 (no. 83).

This species differs from the type of the genus, *D. hookeri*, Hood, in the explanate lateral margins of head, the broader and complete wing-like lateral explanations of prothorax, the series of pronotal setæ, and the abnormally strong spines of the fore-wing, which in *hookeri* are few and inconspicuous. The forms and lengths of abdominal segments 9 and 10 in the two species also differ markedly.

Genus RHIPIPHOROTHRIPS, Morgan.

Rhipiphorothrips, Morgan, Proc. U.S. Museum, vol. xli. p. 17 (August 23, 1913).

Retithrips, Bagnall (nec Marchal), Ann. & Mag. Nat. Hist. ser. 8, vol. xii. (Sept. 1, 1913).

A comparison between *Rhipiphorothrips pulchellus*, Morgan, from Banyan, Philippine Islands, and my *R. bicolor* from Vine, Ceylon, described within a few days of each other, will be interesting. If not one and the same species, they are at least very closely related.

Suborder TUBULIFERA.

Family Ecacanthothripidæ.

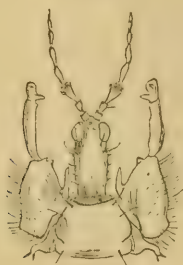
Ecacanthothrips bryanti, sp. n.

♂.—Very like *sanguineus* and *steinskyi*, all tibiæ and tarsi yellow in one specimen, in another hind and intermediate tibiæ brownish. Coloration of antennæ as in *sanguineus*. Postocular bristles present, and also a somewhat similar subgenal bristle behind each eye. Fore-femur with basal tooth long and strong, reddish distally; sparingly setose, the outer margin with a fringe of several longer and shorter hairs.

Antennæ with joints 4-8 longish and slender ; 3 brownish, 4 and 5 brownish, yellowish near base.

Setæ at fore-angles of prothorax long and strong. Abdominal setæ long and strong, colourless ; those on segment 9 longer than the tube. Tube little more than 0.5 the length of the head.

Fig. 2.



Ecacanthothrips bryanti, sp. n. Head, antennæ, prothorax, and fore-legs.

Easily recognized by the long hairs on the fore-femora. Also separated from *steinskyi* by the coloration of the antennæ.

Hab. 2 ♂s, Mt. Matang, W. Sarawak, one from dead tree 17. xii. 13 and the other 17. i. 14. Collected by Mr. G. E. Bryant, to whom I am indebted for some very interesting material, and after whom I find pleasure in naming the species.

Ecacanthothrips sanguineus (Bagnall).

CEYLON, on and under the bark of trees. Respectively met with by both Mr. Green and Mr. Rutherford.

Ecacanthothrips steinskyi (Schmutz), 1913.

Ormothrips steinskyi, Schmutz.

CEYLON, Peradeniya, ♂ and ♀, from bark of tree, 25. v. 13 (*A. Rutherford*).

Ormothrips inermis, Buffa.

BORNEO, 1 ♂, Mt. Matang, W. Sarawak, xii./13 (*G. E. Bryant*).

Family *Phlæothripidæ*.*Docessissophothrips laticeps*, sp. n.

♂.—Length 3·0 mm.

Apterous.

Colour dark reddish-brown; fore-tibiæ and all tarsi yellowish.

Head much as in *D. ampliceps*, Bagn., smooth and shining, about 1·25 times as long as broad, and viewed laterally only weakly arched compared with *ampliceps* and other species of the genus. Eyes small and finely faceted, occupying about 0·2 length of head; ocelli small and widely spaced, a long bristle behind each posterior ocellus; two pairs of long post-ocular bristles, the outer pair being the longer. Genal spinelets few.

Antennæ black, about twice the length of head, joints 2–4 yellowish, 3 grey-brown at apex, and 4 shading to brown apically; 3–5 clavate.

Prothorax strongly transverse, about 2·5 as broad as long and 0·4 the length of head, all setæ long, at least those on hind margin as long as the prothorax. Pterothorax transverse. Legs long, fore-femora not very stout, with long setæ at outer edge near middle, all tibiæ with long setæ near knee, fore-tarsus with tooth. Abdomen broad, with segments strongly transverse, laterally with reddish patches as far as segment 7; 8 rounded sharply to 9, 9 only slightly narrowed. Tube long and stout basally, 1·22 times the length of head, narrowed to distal half, with a weak constriction before apex; surface smooth, but with a scale-like sculpturing, almost aciculate; apical hairs rather short, dark, only about 0·35 the length of the tube, those on 9 about 0·7 as long as the tube, those on 6 and 7 longer than on 9, and on 8 shorter.

Of the described species, *D. ampliceps*, Bagn. (Central America), *D. monstrosus*, Bagn. (New Caledonia), *D. major*, Bagn. (no data), and *D. frontalis*, Bagn. (Japan), this species can only be compared with *ampliceps*, and is separated by its broader and (viewed laterally) less strongly arched head, the three pairs of long cephalic bristles, the longer setæ on fore-margin of prothorax, etc. It is the least extreme species of the genus, whilst *monstrosus* is the most extreme. Only a single example is known of each of these striking species, which would seem to suggest extreme rarity or, perhaps, specialized habitat; the fact that Mr. Bryant found the

specimen under review with termites would seem to strengthen the latter suggestion.

Hab. 1 ♂, Mt. Matang, W. Sarawak, 28. i. 14, under bark with termites (*G. E. Bryant*).

Hindsiania apicalis, sp. n.

♀.—Length 1.7 mm.

Colour yellow to light yellowish-brown; abdominal segments 8 to 10 dark chestnut-brown; head, intermediate and hind tibiae brown. Antennal joints 1, 2, 7, and 8 brown, 2 sometimes yellowish distally, 3 to 5 clear yellow, 6 tinged with brown. Fore-femora and tibiae yellow, tinged to greyish-brown at outer margins; intermediate and hind femora yellow.

Head only about 1.15 times as long as broad; cheeks practically subparallel, almost imperceptibly curved. Mouth-cone not reaching across prosternum, apex almost truncate. Eyes occupying about 0.3 the total length of head; post-ocular bristles neither strong or long, blunt. Ocelli moderately large, posterior pair near to the interior margins of eyes. Antennae about 1.8 times as long as head; relative lengths of segments approximately 6 : 11 : 12 : 14 : 13 : 11 : 11 : 8; 3 obconical, 4 broader than 3 or 5, 7 and 8 broadly united.

Pronotum transverse, about 0.75 the length of head; setae blunt, those at posterior angles about 0.2 the length of pronotum and pair at angles still shorter and weaker; mid-lateral pair apparently obsolete. Pterothorax practically square, as broad as width across fore-coxae. Legs not long, moderately stout; fore-tarsus with a small pointed tooth.

Abdomen occupying about 0.65 the total length of insect, broader at middle than the pterothorax; elongate, about four times as long as broad across segments 3 to 6, and narrowed sharply from base of 8 to apex.

Tube about 0.55 the length of head, 0.65 as broad at base as long, where it is 2.4 times as broad as at extreme apex; sharply narrowed and rather constricted near apex. Terminal hairs a little longer than tube; abdominal hairs moderately long and slender, blunt or faintly knobbed, colourless.

The coloration of the hind and intermediate tibiae is a curious feature, the femora and tarsi being yellow and the tibiae brown.

Hab. INDIA, Almora, Kumaon, 5500 ft., several swept from jungle plant, 4. vii. 11 (*O. Paiva*, no. 4295/20).

Liothrips micrurus, Bagnall.

Ann. & Mag. Nat. Hist. ser. 8, vol. xiii. p. 292 (March 1914).

This species is apparently attached to *Zyziphus spini-christi*, and was described from a specimen obtained by Mr. F. C. Willcocks at Matarieh, near Cairo. Mr. Willcocks has found other specimens on the same tree from Ezbet-el-Nakhl, February, and at Gizeh, near Cairo, March 1911. Evidently rare.

In describing it I stated that a carded specimen captured by Prof. Sahlberg of Helsingfors at Heluan exhibited a pronounced metallic-purplish coloration.

Mr. Willcocks has furnished me with the following live-colour notes of the species—the first known thrips to exhibit metallic coloration of any kind:—

Head, thorax, and abdomen deep metallic violet—in some lights appears jet-black; hairs on abdomen pale. Eyes very dark brown. Antennæ: two basal joints dark, others pale yellowish-brown. Wings silvery, with pale brownish fringe. Legs deep metallic violet.

Genus ALEURODOTHIRIPS, Franklin, 1909.

Chromatothrips, Schmutz (type *C. fasciata*, Schmutz), K. Akad. Wiss. Wien., Mathem.-Naturw. Kl. cxxii., July 1913, p. 1043.

I consider that the type-species of *Chromatothrips* is closely related to *Aleurodothrips fasciatipennis*, Franklin, and congeneric with it.

Aleurodothrips fasciapennis (Franklin).

Ceylon, Peradeniya, 1 ♂ taken by Mr. A. Rutherford among *Aspidiotus lataniæ*, 27. vi. 1913.

The only difference I can detect in this example and specimens from Florida lies in the coloration of the antennæ, the former having the sixth joint entirely grey-brown. *A. fasciatus* closely resembles this species, but is easily distinguished by the coloration of the body, antennæ, and legs.

Androthrips flavipes, Schmutz.

Androthrips flavipes, Schmutz, l. c. cxxii. p. 1031 (July 1913); Bagnall, Ann. & Mag. Nat. Hist. ser. 8, vol. xiii. p. 27 (Jan. 1914).

XXVIII.—*Notes on the Apidæ (Hymenoptera) in the Collection of the British Museum, with Descriptions of new Species.*
By GEOFFREY MEADE-WALDO, M.A.

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VI.

AMONG the large collections of Hymenoptera made by Mr. R. E. Turner in Western Australia during his recent visit, probably no single genus is more richly represented than *Megachile*. The earlier species (those collected at Yallingup) were principally found burrowing in the sand, in which they made their cells, or entering holes made by beetles in the tree-trunks; those collected later were irresistibly attracted by the blossoms of gum- and acacia-trees.

Altogether twenty-four species were collected between October 1913 and February 1914, of which six are described as new. In working these out I have had the advantage of consulting Professor Cockerell's MS. keys to the Australian *Megachile*, and have found them extremely useful; by their means I have been able to arrive at the affinities between the new species and described species I have not seen. The discovery of a female *Thaumatosoma* is very satisfactory.

A complete list of the species of *Megachile* taken is given. Mr. Turner's itinerary was as follows:—Yallingup, Oct. 1913–Jan. 23, 1914; Busselton (20 miles E. of Yallingup), Jan. 24–27, 1914; Perth (150 miles N.N.E. of Busselton), Feb. 1–7, 1914; Kalamunda (15 miles E. of Perth), Feb. 9–28, 1914.

1. *Megachile (Eumegachile) aurifrons*, Smith.

Perth, Feb. 1914. 2 ♀ ♀.

2. *Megachile (Eumegachile) erythropyga*, Smith.

Yallingup, Kalamunda, Perth. A long series of both sexes.

3. *Megachile (Eumegachile) nasuta*, Smith.

Yallingup. 14 ♀ ♀.

4. *Megachile eriadiformis*, Smith.

Yallingup. A long series of both sexes.

5. *Megachile fabricator*, Smith.

Kalamunda, Perth. 1 ♀, 8 ♂ ♂.

6. *Megachile chrysopyga*, Smith.

Yallingup, Kalamunda, Perth. A long series of both sexes.

7. *Megachile cygnorum*, Ckll.

Perth. 2 ♂ ♂.

8. *Megachile obtusa*, Smith.

Yallingup. 9 ♀ ♀, 7 ♂ ♂.

9. *Megachile hampsoni*, Ckll.

Yallingup. 10 ♀ ♀.

10. *Megachile ferox*, Smith.

Yallingup. 3 ♀ ♀, 10 ♂ ♂.

11. *Megachile trichognatha*, Ckll.

Kalamunda, Perth. A long series of both sexes.

12. *Megachile apicata*, Smith.

Busselton, Yallingup. A series of both sexes.

13. *Megachile clypeata*, Smith.

Busselton, Yallingup. 8 ♀ ♀, 4 ♂ ♂.

14. *Megachile sexmaculata*, Smith.

Yallingup, Perth. 2 ♀ ♀, 1 ♀.

15. *Megachile serricauda*, Ckll.

Perth. 2 ♂ ♂.

16. *Megachile 5-lineata*, Ckll.

Kalamunda. 1 ♀.

17. *Megachile kirbyana*, Ckll.

Yallingup. A long series of both sexes.

18. *Megachile oculipes*, Ckll.

Perth. 9 ♂ ♂.

Key to the new Species.

♀ ♀.

Abdomen mostly black, end of abdomen red, the colour either tegumentary or due to hair.

1. (4) Apex of abdomen with the tegument red.
2. (3) Head, thorax, and abdomen for the most part clothed with fulvous-grey pubescence; tergites 4-6 almost completely dusted with such pubescence; clypeus with the apex emarginate; a broad species, 11 mm. *leeuwinensis*, sp. n.
3. (2) Thoracic and abdominal pubescence griseous; clypeus truncate at apex; a small slender species, 8½ mm. *longiceps*, sp. n.
4. (1) Apex of abdomen with tegument not red.
5. (10) Clypeus very short, deeply emarginate, at least with lateral teeth or laminae.
6. (7) Small (about 8 mm.). Mandibles bidentate; clypeus with a median tooth and a large process on each side *preissi*, Ckll. (1910).
7. (6) Larger (12-15 mm.). No median tooth on clypeus at apex; mandibles 3-4-toothed.
8. (9) Mandibles deeply furrowed along the inner margin, 3-toothed, a large blunt tubercle on the outside at base; axillæ with a distinct patch of whitish pubescence. 15 mm. *axillaris*, sp. n.
9. (8) Mandibles normal, not furrowed along the inner margin, and no tubercle at base, no patches of pale pubescence on axillæ. 12 mm. *speluncarum*, sp. n.
10. (5) Clypeus about half as long as broad, the apex at least not deeply emarginate.
11. (12) Scopa black; abdomen black, tergites 1, 2, and 3 (partly) with white apical fasciæ of pubescence, tergite 6 with a small patch of ferruginous red hair. 16 mm. *resinifera*, sp. n.
12. (11) Scopa pale, sternite 6 sometimes fuscous.
13. (14) Upper part of clypeus with a median raised line, its lower margin 4-dentate, the teeth small [(1910). *remotula*, Ckll.
14. (13) Clypeus truncate at apex, no median raised line.
15. (16) Abdomen subparallel-sided, tergites 5 and 6 with red hair-patches *ferox*, F. Smith.
16. (15) Abdomen ovate; tergite 6 (and sometimes 5 at extreme apex) with red hair. *subferox*, sp. n.

♂ ♂.

1. (4) Anterior tarsi simple or flattened, but not conspicuously dilated; pubescence of head and thorax griseous.

- | | | | |
|----|-----|---|-------------------------------|
| 2. | (3) | Anterior tarsi simple; tergite 6 concave above, rounded and bilobed at apex. 11 mm. | <i>subferox</i> , sp. n. |
| 3. | (2) | Anterior tarsi flattened; tergite 6 truncate at apex, serrate. 15 mm. | <i>resinifera</i> , sp. n. |
| 4. | (1) | Joint 2 of anterior tarsi conspicuously dilated; pubescence of head and thorax fulvous grey. | <i>leeuwiniensis</i> , sp. n. |

19. *Megachile axillaris*, sp. n.

♀. Nigra; facie, thorace, tergitebus 1-3 lateribus, scopaque ventrali (sternite sexto excepto) albo-pilosis; tergitebus 5 et 6 rufaurantiacis; alis subhyalinis; clypeo brevissimo, emarginato, lateribus laminatis; mandibulis 3-dentatis, basis externis tuberculatis.

Long. 15 mm.

Black; clypeus, the inner orbits, thorax (especially pleuræ), axillæ and median segment, linear marks on sides of apices of tergites 1-3 with white pubescence; ventral scopa (except sternite 6) silvery white, sternite 6 fuscous; legs more or less sparsely clothed with griseous pubescence, tarsi reddish beneath. Mandibles on the inner and outer sides and tergites 5 and 6 with bright ferruginous-red pubescence.

Mandibles broad at base, narrowing considerably towards apex, tridentate, an opaque area (almost smooth) at base, enclosed between conspicuous shining carinæ approximating towards the apex; inner margin well sculptured, outer margin with a distinct tubercle at base.

Clypeus very short, broad, and deeply emarginate, sides of the emargination produced to form distinct subquadrate laminæ.

Head as broad as thorax at widest; abdomen parallel-sided. The whole closely and finely punctured, except enclosed area at base of median segment, the truncation of tergite 1, and the median segment itself, which are subnitidulous and impunctate.

Wings subhyaline.

Length 15 mm.

S.W. AUSTRALIA: Yallingup, 23rd Dec. 1913-23rd Jan. 1914 (*R. E. Turner*). 18 ♀ ♀.

Apparently comes next to *M. preissi*, Ckll. (1910), from Eastern Australia, but much larger; also in *M. preissi* the clypeus has a median tooth and the abdominal hair-fasciæ entire.

20. *Megachile speluncarum*, sp. n.

♀. Nigra, plerumque griseo-pilosa; tergitebus 1-3 fasciis apicalibus albidis, 5 plerumque et 6 omnino rufo-aurantiacis; alis subhyalinis; scopa ventrali alba; clypeo brevissimo, emarginato, lateribus sublaminatis; mandibulis 4-dentatis.

Long. 12 mm.

Black; face and thorax more or less densely clothed with griseous pubescence, densest on inner orbits, pleuræ, and median segment; tergites 1-3 with narrow apical fasciæ of the same pubescence, the sides much denser than median area; scopa silvery white (except sternite 6), sternite 6 fuscous; legs, and especially tarsi of intermediate legs, with griseous pubescence. Tergites 5 (except base and sides) and 6 bright ferruginous red. Mandibles and clypeus with a few ferruginous hairs.

Mandibles broad, of uniform width throughout, quadridentate, evenly punctured, with inconspicuous carinæ; inner margin normal.

Clypeus very short, convex, deeply emarginate, sides of the emargination forming distinct sublaminar processes.

Head as broad as the thorax at widest; abdomen parallel-sided, tergite 3 with a transverse sulcus.

The whole insect uniformly punctured, the punctures even, of medium size; enclosed area at base of median segment, truncation of first tergite, and tegulæ impunctate.

Wings subhyaline.

Length 12 mm.

S.W. AUSTRALIA: Yallingup, 23rd Dec. 1913-23rd Jan. 1914 (*R. E. Turner*). 12 ♀ ♀.

21. *Megachile resinifera*, sp. n.

♀. Nigra, capite thoraceque griseo-pilosis; tergitebus 1 et 2 omnino, 3 lateribus fasciis apicalibus albidis; tergite 6 vix rufo-aurantiaco; scopa ventrali nigra; clypeo latiore quam longiore, apice truncato; mandibulis tridentatis; alis subhyalinis.

Long. 16 mm.

♂. Femina hirsutior, fasciis apicalibus abdominis caret; tarsis anticis vix dilatatis; tergite septimo concavo, producto, apice subserrato.

Black, head and thorax rather profusely clothed with pubescence, that on the vertex and disk of mesonotum fuscous, the front, cheeks, pleuræ, and median segment griseous; tergites 1 and 2 with distinct apical fasciæ and

tergite 3 laterally with white pubescence; tergite 6 with a patch of ferruginous-red hairs. Scopa black. Wings subhyaline.

Mandibles fairly robust, tridentate, with distinct carinæ towards apex.

Clypeus rather broader than long, the apex truncate. There is a sharp tubercle on the metasternum between the hind coxæ. Abdomen parallel-sided, tergites 2 and 3 with broad, shallow, transverse sulci. Whole covered with uniform fine punctures, enclosed area at base of median segment and truncation of first abdominal segment impunctate.

Length 16 mm.

♂. Differs from the ♀ in having only lateral spots (*not* fasciæ) on the apex of segments 1 and 2; the general appearance is more hirsute than the ♀. In secondary sexual characters the following are chiefly noticeable:—antennæ simple; anterior tarsi flattened, not dilated, their colours from ferruginous to ivory-white. Tergite 7 is black; concave, but curled out towards apex; the apex is serrate.

Length 15 mm.

S.W. AUSTRALIA: Yallingup, Nov.–Dec. 1913 (*R. E. Turner*).

A long series of both males and females.

The sexes of this fine species are very different in appearance, but Mr. Turner has no doubt whatever that they are correctly associated. He found the females burrowing in sandy banks and the males flying round the burrows in profusion. Some of the females have large globules of gum in their mandibles, evidently taken up from the *Eucalyptus* known as the "red gum." The gum thus collected is probably used either to keep the sand from falling in on the burrows or to gum together the leaves of which the cells are made. Similar gum was found in the mandibles of specimens of *M. nasuta*, F. Smith.

22. *Megachile leeuwinensis*, sp. n.

♀. Nigra; capite, thorace, tergitebus 1–5 fasciis apicalibus griseo-pilosis; sternitibus 5+6 tergiteque 6 rufis, pallide hirsutis; scopa plerumque albida; clypeo brevi, apice emarginato; mandibulis robustis, dentatis; alis hyalinis.

Long. 11 mm.

♂ similis, sed tergitebus 5–7 rufis; articulo 2 tarsorum dilatato, tergite 7 concavo-dentato.

Black; head, thorax, and apical fasciæ on tergites 1–5 clothed with fulvous-grey pubescence; tergites 4–6 more or

less completely dusted with fulvous-grey pubescence ; tergite 6 and sternites 5 and 6 have the chitin dull red. Legs sparsely clothed with greyish hair, tarsi with ferruginous-red pubescence within.

Wings hyaline.

Mandibles robust, with two distinct apical teeth and two smaller ones towards the base, hardly carinate.

Clypeus short, convex, the apex with a broad shallow emargination, its edge somewhat irregular.

Abdomen short, widest in the middle.

Whole insect for the most part covered with small even puncturing ; tergites 4-6 more coarsely punctured, the enclosed area at base of median segment, the truncation of segment, and tegulæ impunctate.

Length 11 mm.

♂. Similar to the ♀ in general appearance, but with the three last tergites dull red.

Fig. 1.



Megachile leeuwinensis, ♂. Anterior tarsi.

Anterior tarsi for the most part ferruginous, the dilatation on joint 2 ivory-white ; first tarsal joint with a fringe of silky-white hairs of medium length on the outside ; mixed with this fringe are a few (about ten) very long, stout, ferruginous hairs, second tarsal joint with a long spine at apex, the remaining tarsal joints with ferruginous hair. Tergite 7 concave, the apex with two small tubercles rather widely separated.

S.W. AUSTRALIA : Yallingup, 23rd Dec. 1913-23rd Jan. 1914 (*R. E. Turner*), 10 ♀ ♀, 8 ♂ ♂.

Rather resembles a large *M. apicata*, Smith. The dilated second tarsal joint is an interesting character in the ♂, and the curious long, stout hairs on the metatarsus are very noticeable.

Megachile ferox, Smith, ♀.

There is a good series of males of this striking species in the collection from Yallingup, and also three specimens which are certainly the female. As the male is the only described sex, a short description of the female is added:—

♀. Nigra, plerumque griseo-pilosa; tergitis 1-3 obscure griseo-fasciatis, 5-6 plus minusve rufo-aurantiacis; alis subhyalinis; scopa ventrali alba; clypeo latiore quam longiore, apice truncato; mandibulis robustis obscure dentatis.

Long. 12 mm.

General facies similar to the male.

Black, head and thorax more or less densely clothed with griseous pubescence, densest on inner orbits and median segment, with distinct white spots on sides of pronotum, mesopleuræ, and axillæ, tergites 1-3 or 4 with narrow apical fasciæ of same colour; scopa silvery white, sternite 6 fuscous; tergites 5 and 6 clothed with bright ferruginous red, a few ferruginous hairs on clypeus and mandibles.

Wings subhyaline.

Mandibles robust, of uniform width; only two distinct teeth, their surface with two conspicuous carinæ in addition to the outer margin.

Clypeus rather broader than long, the apex truncate.

Head about as broad as thorax; abdomen parallel-sided, tergites 3 and 4 with transverse sulci. The whole uniformly punctured, the punctures even, of medium size; enclosed area of median segment, truncation of tergite 1, and tegulæ impunctate.

Wings subhyaline.

Length 12 mm.

This species is closely allied to *M. subferox*, but the differences noted in the key should serve to separate them.

23. *Megachile longiceps*, sp. n.

♀. Nigra, clypeo fronteque pallide aureo-pilosis; area intra-orbitali, genis, thorace ubique, abdominis segmentis 1-4 fasciis apicalibus, pedibusque plerumque albo-pilosis; scopa ventrali alba; tergite sterniteque 6 rufis, griseo-pubescentibus; clypeo apice subtruncato; alis hyalinis.

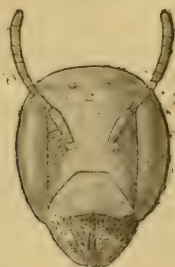
Long. $8\frac{1}{2}$ mm.

Black; front and clypeus rather sparsely clothed with golden pubescence; inner orbits, cheeks, the whole thorax,

narrow apical fasciæ on tergites 1-4, and the legs clothed with whitish pubescence; scopa silvery white. Tergite and sternite 6 reddish, the pubescence pale golden.

Wings hyaline.

Fig. 2.



Megachile longiceps, ♀. Front view of head.

Head, viewed from the front, very long, about $1\frac{1}{2}$ as long as broad; *mandibles* robust, the cutting-edge without teeth, their surface with one distinct carina; *clypeus* broader than long, shallowly emarginate at apex; abdomen parallel-sided, tergites 2-4 with shallow transverse furrows near their base. The whole covered with small even punctures, except the enclosed space at base of median segment, the truncation of tergite 1, and the tegulæ, which are impunctate.

Length $8\frac{1}{2}$ mm.

S.W. AUSTRALIA: Yallingup, 23rd Dec. 1913-23rd Jan. 1914 (type), 3 ♀ ♀; Busselton, 24th-27th Jan. 1914 (*R. E. Turner*), 4 ♀ ♀.

This little species bears a strong resemblance to *M. apicata*, Smith, from Adelaide and West Australia, and *M. clypeata*, Smith, from West Australia. From the former it may be distinguished by its peculiarly long head (viewed from the front) and from the latter by its normal clypeus, that of *M. clypeata* having two striking tubercles.

24. *Megachile subferox*, sp. n.

♀. Nigra; facie, pleuris, segmento mediano, tergitis 1-4 fasciis apicalibus plus minusve interruptis, pallide pilosis; scopa ventrali alba; tergite 6 rufo-aurantiaco; clypeo subquadrato, apice truncato; mandibulis robustis, apice carinatis; alis subfuscis.

Long. 11 mm.

♂ similis, sed hirsutior; tarsis anticis simplicibus, tergite apicali concavo, apice rotundo bilobato; tergitibus 4 apice et 5 rufo-aurantiacis.

Long. 11 mm.

Black, the inner orbits, prothorax, and postscutellum with pale fuscous hair; postorbits, pleuræ, and four spots on mesonotum with whitish pubescence; basal tergite with some long pale hair, tergites 2-4 with apical fasciæ of pale scale-like hairs, rather broken in the middle. Ventral scopa white. Legs sparsely clothed with griseous pubescence; tarsi reddish within. Tergite 6 (and sometimes tergite 5 at apex) densely clothed with ferruginous-red pubescence.

Mandibles massive, the cutting-edge irregularly serrate, the base without distinct sculpture, but with two conspicuous carinæ converging towards the apex.

Clypeus flat, subquadrate, the apex truncate.

The head and thorax are covered with fine even punctures, the thorax with somewhat coarser granular punctures; tergites 2-4 have distinct transverse sulci towards the base.

Wings suffused with fuscous.

Length 11 mm.

♂. Very similar to ♀ in general appearance, but with much longer hair; the pale markings on abdomen are entirely lateral; the reddish-ferruginous pubescence is on tergites 4 (apically) and 5. Anterior tarsi simple, apical segment of abdomen roundly bilobed.

Length 11 mm.

S.W. AUSTRALIA: Yallingup, Nov. 1913-Jan. 1914; Busselton, Jan. 1914 (*R. E. Turner*). A long series of females and five males.

Comes very near to *M. ferox*, Smith; for differences see key to the species.

THAUMATOSOMA, Smith.

Thaumatosoma duboulayi, Smith.

S.W. AUSTRALIA: Yallingup, 14. x. 1913 (1 ♂) and 1. xi. 1913 (1 ♀) (*R. E. Turner*).

This is the first-recorded female in this interesting genus, the four species known at the present time being all described from males.

For a key to the species see *Ann. & Mag. Nat. Hist.* (8) xii. p. 492 (1913); *T. testaceicorne*, Cam. (1908), described from Matheran, N. India, is omitted from this key.

♀. In colour and distribution the pubescence resembles the ♂ and *Megachile* species of the *M. heriadiformis* group. Abdomen distinctly narrowed basally, not parallel-sided, gradually widening towards apex of tergite 3; apical segments rather flattened. Mandibles and clypeus almost as in the subgenus *Eumegachile*; mandibles of equal width along the greater part of their length, rather expanded at apex;

Fig. 3.



Thaumatosoma duboulayi, ♀, and front view of head.

clypeus very short, with a slight emargination at apex, the middle with a longitudinal carina. No malar space. Antennæ 12-jointed. Head very broad, widest at the base of the mandibles. Ventral scopa very pale yellowish. Head, thorax, and tergites 1-4 with even fine punctures, tergites 5 and 6 coarser.

Length 12 mm.

XXIX.—*A new Shrew of the Genus Blarinella from Upper Burma.* By OLDFIELD THOMAS.

(Published by permission of the Trustees of the British Museum.)

MR. F. KINGDON WARD, who had already sent various small mammals from Western China, has now obtained for the British Museum a few from the mountains in the north of Upper Burma. Besides a *Pachyura* and a *Vandeleuria*, already known from Burmese territory, they include three forms of Chinese affinity, namely *Apodemus speciosus orestes*,

Chimarrogale styani (the second known example), and the following new *Blarinella*, a genus hitherto only recorded from Western China.

Blarinella wardi, sp. n.

Colour both above and below of the same dark smoky grey as in *B. quadraticauda*, therefore darker than in the mouse-grey *B. griselda*. Tail slightly longer than in the latter species.

Skull of about the same length as in *B. griselda*, therefore shorter than in *quadraticauda*; breadth, however, conspicuously less, especially across the brain-case. Owing, however, to the fact that the brain-case of the only specimen is somewhat damaged, so that a certain doubt attaches to the chief measurement given below, I may note that the breadth between the outer corners of the glenoid processes is only 5.0 mm., as compared with 5.8 in *griselda*, this part being unaffected by the damage to the typical skull. Side-walls of mesopterygoid fossa not so completely reticulated as in the type of *B. griselda*.

Teeth, in relative proportions, about as in *B. quadraticauda*, but both first and second unicuspid considerably smaller.

Dimensions of the type (measured in flesh):—

Head and body 70 mm.; tail 35; hind foot 11; ear 4.

Skull: length 18; condylo-incisive length 19.3; greatest breadth across brain-case (c.) 8.5; upper tooth-series 8.4; front of p^4 to back of m^2 4.3; breadth between outer corners of m^2 4.9; lower tooth-series 7.7.

Hab. Hpimaw, Upper Burma, about 26° N., 98° 35' E. Alt. 8000'.

Type. Adult male. B.M. no. 15.2.1.3. Original number 2. Collected 10th August, 1914, by F. Kingdon Ward. Presented by Oldfield Thomas.

This species is readily distinguishable from the *B. quadraticauda* of Sze-chwan by its smaller size, and from *B. griselda* of Kansu by its darker colour and much narrower skull.

The curious imperfection or reticulation of the lateral walls of the mesopterygoid fossa noticed above would seem to be a character peculiar to *Blarinella*, as I do not find it in *Blarina* or any other genus of shrews.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

December 2nd, 1914.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The following communication was read:—

‘On a Bone Implement from Piltown (Sussex).’ By Charles Dawson, F.S.A., F.G.S., and A. Smith Woodward, LL.D., F.R.S., Pres.G.S.

During the past season the Authors have continued excavations in the Piltown gravel round the edge of the area previously explored. Rolled fragments of highly mineralized teeth of *Rhinoceros* and *Mastodon* were again found, but no human remains were met with. The most important discovery was a large bone implement, which is now described. This specimen was found in dark vegetable soil beneath the hedge which bounds the gravel-pit, not far from the spoil-heap whence the right parietal bone of the Piltown skull was obtained two years ago. On being washed away the soil left no stain on the bone, which was covered with firmly-adherent yellow clay, closely similar to that of the flint-bearing layer at the bottom of the gravel. The bone itself is highly mineralized, and agrees exactly in appearance with some small fragments of bone which the Authors discovered actually in place in the clay just mentioned. There can be no doubt, therefore, that the implement was found by the workmen when they were digging gravel from the adjacent hole, and was thrown away by them with the other useless debris. It is a stout and nearly straight narrow flake of bone, 41 cm. long, and varying from 9 to 10 cm. in width, with the thicker end artificially pointed, the thinner end artificially rounded. It appears to be a longitudinal strip flaked from a limb-bone by a blow at the thicker end, in the same way as flint implements were flaked from their original cores. Direct comparison suggests that it was taken from a Proboscidean femur as large as that of *Elephas meridionalis*. In microscopic structure it agrees with Proboscidean bone. The two ends of the implement are shaped entirely by cutting, and bear no marks of grinding or rubbing. Most of the cut facettes are small, and many of them suggest that they were made by some primitive tool, presumably a flint. The rounded end seems to have been trimmed for comfortable handling. The thick pointed (or, rather, keeled) end does not show any signs of battering or scratching by use. Just above the pointed end one lateral edge of the bone is marked by a large smooth groove running across from the inner to the outer face of the bone. It seems to have been originally a perforation from which the outer wall has been accidentally broken away. Within it on the inner face is the beginning of a second similar perforation, as if an attempt had been made to repair the damage. The Authors conclude that the implement is unique, and are unable to explain its specific use.

December 16th, 1914.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

A Lecture was delivered by Prof. W. M. FLINDERS PETRIE, D.C.L., LL.D., F.R.S., F.B.A., on the Palæolithic Age and its Climate in Egypt.

He said that the classes of worked flints peculiar in Egypt are : (1) Irregular, with broad unregulated fractures. (2) Rounders, flaked in all directions to an edged disc. (3) Hoofs, very thick, rudely domed with an obtuse edge. (4) Lunes, with obtuse edges. (5) Crescent scrapers. Irregular flints, similar to those from St. Acheul, are found in high Nile gravels.

The regular European types occur exactly like those classed as Chellean and Acheulian. The Mousterian forms are so often found in various periods, that they cannot be assigned without evidence of age. The Aurignacian survive into the early civilization. The large class of flints from the Fayum desert comprises all the Solutrean types, and also Robenhausian forms. The flakes of the early civilization (8000 to 6000 B.C.) are identical with Magdalenian.

Views of the Nile cliffs show the general nature of the country and conditions. Successive changes of level are indicated by (1) the collapse of immense drainage-caverns far below present level; (2) the filling of valleys with débris up to 650 feet above the present sea-level; (3) the gouging-out of fresh drainage-lines through the filling; and (4) rolled gravels on the top of cliffs 800 feet above sea-level, since when there has been no perceptible denudation by rain. The great extent of these elevations and depressions is likely to be connected with similar movements at Gibraltar, which are believed to synchronize with the movements of glacial periods in Northern Europe. The evidence of the flint ages agrees with this connexion.

January 20th, 1915.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The following communications were read :—

1. 'The Geology of the District around Machynlleth and the Llyfnant Valley.' By Prof. Owen Thomas Jones, M.A., D.Sc., F.G.S., and William John Pugh, B.A., University College of Wales, Aberystwyth.

In an introduction a brief account is given of the physical features, general succession, and structure of the area, and reference is made to the work of previous investigators, especially to that of Walter Keeping. For the major groups the classification applied in 1909 to the district around Plynlimon and Pont Erwyd is adopted, but slight differences are introduced in the arrangement of the minor groups. The classification is as follows :—

VALENTIAN (SILURIAN).	B. PONT ERWYD STAGE.	C. YSTWYTH STAGE.	Pale mudstones with numerous laminated grit-bands.		
			Derwen b. Group. 190 feet.	5. Zone of <i>Monograptus halli</i> .	Pale-blue and green- ish mudstones with bands of dark graptoliferous shales, and some thin green flags.
				4. Zone of <i>Monograptus sedgwicki</i> .	
				3. Zone of <i>Monograptus regularis</i> .	
HARTFELL (ORDO- VICIAN).	A. PLYN- LIMON STAGE.		2. Zone of <i>Monograptus leptotheca</i> .	Dark rusty- weathering shales and limestones. 'Mottled Beds' and blue mudstones.	
			1. Zone of <i>Mesograptus magnus</i> .		
			3. <i>Monograptus</i> spp. Beds.		
			2. Zone of <i>Diplograptus acuminatus</i> .		
			Cwmere a. Group. 334 feet.	1. Zone of <i>Glyptograptus persculptus</i> .	
			Ty'n-y-maen Group.	Dark mudstones, grits, and some conglomerates.	

The distribution and characters of these beds are described. The 'Mottled Beds' form the base of the Silurian and rest sharply on the underlying beds, and there is evidence of complete discontinuity at this level; they have proved of great service in elucidating the structure. The *Monograptus* spp. Beds contain graptolites which elsewhere pertain to the zones of *Monograptus triangulatus*, *M. cyphus*, and *M. acinaces*; but another zone, that of *M. atavus*, has not been proved, although it probably occurs. The Derwen Group consists of a regular alternation of mudstones and shale-bands with graptolites, which have also proved of service in mapping. Only a small thickness of the Ystwyth Stage occurs, and no subdivisions are attempted.

The rocks are sharply folded, and sometimes overfolded, towards the east. Their axes range approximately north-north-east and south-south-west; the folds in the central area pitch northwards, but north of the Dovey a southerly pitch sets in. Each large fold is composed of a number of smaller folds having parallel axes, and changing in pitch more frequently than the larger folds. Strike-faults of considerable magnitude range nearly parallel with the folding axes, and are in all cases overthrusts towards the east.

Of greater interest are the transverse faults ranging nearly east-north-east and west-south-west. Most of these are small, but their course across the higher ground is indicated by well-defined notches in the ridges that they cross. Two of these faults, the Pennal and Llyfnant Faults, are shatter-belts. The Llyfnant Fault displaces several folding axes, and overthrusts to the east on the north side. Its vertical displacement is on an average about 300 feet,

but its horizontal displacement is usually over 3000 feet. It may therefore be called a 'tear-fault.' Both the Llynant and the Pennal Faults exercise some influence upon the drainage-system of the area.

A brief comparison of the succession with other districts is added.

2. 'The Geology of the District between Aberciddy and Abercastle (Pembrokeshire).' By Arthur Hubert Cox, M.Sc., Ph.D., F.G.S.

The district is situated north-east of the area occupied by the pre-Cambrian rocks of St. Davids, and it is bounded on its northern side by the Pembrokeshire coast. Although some parts of this district have already been the subject of geological investigation, yet the stratigraphy and structure of the greater part is now described for the first time. Aberciddy itself has been, since the time of Hicks, a type-locality for the Llanvirn Beds, but observations recently made by Prof. O. T. Jones showed that the sequence required reinvestigation. It has now been found that the Ordovician rocks of the district do not succeed one another in a simple upward sequence, but that they have been thrown into great folds and sometimes even overfolded. The folds have subsequently been broken by extensive strike-faulting. The limbs of the folds increase in steepness as the pre-Cambrian massif is approached. This folding brings up strips of Cambrian rocks, the presence of which on the North Pembrokeshire coast was previously quite unsuspected.

There is a complete sequence of Ordovician rocks from near the base of the Arenig Series to high up in the Glenkiln Group. The lowest Arenig rocks are a series of arenaceous strata (the Abercastle and Porth Gain Beds) which correspond to the '*Nesuretus* Beds' of Ramsey Island. These strata are in faulted relationship to the Cambrian, so that the true base of the Arenig is not seen. The arenaceous beds pass upwards without a break into *Tetragraptus* Shales, which are in turn succeeded by the *Bifidus* Beds. Llanvirnian volcanic rocks are represented in one part of the district by the Llanrian Volcanic Series, which begins high up in the zone of *Didymograptus bifidus*, and in another part by the *Murchisoni* Ash, which forms the base of the *D.-murchisoni* Zone. The Llandeilo Series compares closely with that of Carmarthenshire, and does not contain any volcanic rocks as was at one time supposed.

Contemporaneous igneous rocks occur at two horizons:—(i) keratophyres at a high horizon in the *Tetragraptus* Shales, and (ii) quartz-keratophyres (soda-rhyolites) towards the top of the *D.-bifidus* Beds. The intrusive rocks (diabases) belong to two types, (a) subophitic quartz-diabases, and (b) ophitic diabases without quartz. Both types were intruded earlier than the main folding, and consequently earlier than the cleavage and faulting.

A great north-westerly line of disturbance—the Pwll Strodyr Fault—cuts across all other structures, and brings on entirely different groups of strata.

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[EIGHTH SERIES.]

No. 88. APRIL 1915.

XXX.—*Descriptions and Records of Bees.*—LXVI.

By T. D. A. COCKERELL, University of Colorado.

Pasiphaë cyanea, sp. n.

♀.—Length about 11 mm., expanse 17·5.

Rather robust, shining dark blue, with the knees, tibiae, and tarsi bright ferruginous, with hair of the same colour; scape black, but the rather short and thick flagellum ferruginous; hair of head, thorax, abdomen, and basal part of legs black, but at apex of abdomen, on each side of the apical plate, ferruginous, contrasting with the thick black hair on fifth segment; region of mouth with red hairs; head broad, front with long coarse hair; mandibles simple, truncate; labrum entire; clypeus finely punctured, its lower margin black; fourth and fifth antennal joints very short; mesothorax shining, very finely punctured; scutellum with a longitudinal median impression; area of metathorax large, triangular, rough but glistening; thorax with long hair, but the mesothorax (except anterior border) and scutellum bare, while beneath the wings is a circular bare area, which is blue, contrasting with the more lilac adjacent parts; tegulae dark rufous. Wings hyaline, faintly dusky, the nervures and stigma bright amber-colour; b. n. meeting t.-m., the latter bent in the middle; upper side of first discoidal arched; second s.m. very long, narrowed about half above, receiving first r. n. at a distance from base equal

to about four-fifths of length of first t.-c.; second r. n. received a short distance from apex; marginal cell rounded at apex; outer upper corner of third discoidal approximately rectangular. Abdomen shining, with only very minute and feeble punctures, hind margins of second and third segments reddish. Hind tibial scopa red, abundant, long and loose.

Hab. Rio McClelland, Tierra del Fuego, 12. i. 1905 (*R. Crawshaw*). British Museum. Found "in the face of the cliff, on the sea-shore."

This differs from *Pasiphaë*, as originally defined, by the large ocelli forming a curve rather than a triangle, the robust antennæ, the marginal cell obtuse at apex (though with a very small appendicular nervure), and the labrum not emarginate. Except for the slight appendage at the end of the marginal cell, the venation agrees with that of *Bicolletes neotropica*, Friese (which is herewith designated as the type of *Bicolletes*), but *Bicolletes* is scarcely to be separated generically from *Pasiphaë*. *P. cyanea* is readily known from most species by its blue colour; it is, perhaps, related to *P. cærulescens*, Spinola, which is unknown to me, and seems not to have been found since it was described in 1851.

Capicola (?) *basutorum*, sp. n.

♂.—Length about 12 mm.

Slender; head, thorax, and first abdominal segment black, rest of abdomen dark reddish fuscous; mandibles reddish, with the base pallid and yellowish; clypeus black; flagellum bright orange-fulvous, about the basal third black above; tubercles yellow; coxæ, trochanters, and base of femora piceous, legs otherwise light yellow suffused with ferruginous; tegulæ hyaline, rufo-testaceous. Wings smoky, hyaline, and stained with orange basally; stigma light orange-ferruginous; nervures fuscous, the subcostal black, but the costal and other nervures toward base of wing ferruginous. Labrum emarginate; head broader than long, eyes prominent; face densely covered with light ochreous hair; antennæ only moderately long, flagellum thick; ocelli rather large; vertex with thin reddish hair; region on each side of ocelli smooth, with few strong punctures; thorax with thin reddish hair; mesothorax and scutellum shining, with very large scattered punctures; area of metathorax with about ten very strong ridges, the intervals shining—this region is bounded by an elevation, below which are short oblique plicæ. Wings large and ample; marginal

cell long, ending in a rather obtuse point nearly on costa; stigma large; two submarginal cells, the second one very long, narrowed more than half above; b. n. falling a considerable distance short of t.-m.; first r. n. entering second s. m. a long distance from its base, and the second almost as far from its apex. Legs slender and simple; claws very small, pulvilli distinct. Abdomen narrow and shining, scarcely punctured, with thin reddish hair, denser at ends of last three segments; pygidial area distinct, apical plate black, with spoon-like outline.

Hab. Basutoland, Africa (*R. Crawshay*). British Museum.

This represents a genus allied to *Rhoplites*, but distinct. *Capicola* and *Rhinochatula* of Friese were based on South African species of this immediate group, and while the present insect appears to be very distinct from the seven forms ascribed to these genera by Friese, it may for the present be regarded as a doubtful *Capicola*. Friese cites no type for *Rhinochatula*; *R. cinctiventris* is herewith designated as the type of that genus.

Paracolletes callander, sp. n.

♀.—Length about 16 mm.

Black, with the flagellum beneath (except basally) and the small joints of tarsi ferruginous; hair of head and thorax abundant, warm pale reddish, paler beneath, on cheeks and on metathorax, reddest at sides of mesothorax and the region about tubercles; clypeus only very thinly hairy, shining, with scattered distinct punctures; supraclypeal area smooth; sides of vertex dull, but region behind ocelli shining; mesothorax and scutellum dull, hairs on scutellum, as well as a patch below and in front of wings, tipped with fuscous; area of metathorax dull, without distinct sculpture; tegulae black, covered with hair in front. Wings smoky, nervures dark brown, stigma little developed; b. n. falling a little short of t.-m.; second s. m. very broad, receiving first r. n. about middle. Legs with hair coloured like that on thorax, but hind tibial scopa long and loose, glistening silvery, though reddish-tinted. Abdomen dull, with a finely roughened surface; hind margins of the first four segments with narrow hair-bands, the first feeble, the others appearing as narrow but conspicuous white lines; apical plate very large and broad, the surrounding hair dark chocolate, but nearly white at sides of apical part of abdomen.

♂.—Length about 13.5 mm.

More slender; abdomen (except lateral black marks,

especially a large round patch at sides of second segment), apical part of femora above (on anterior and middle ones extending below middle), knees, tibiæ (except a suffused dusky patch on middle and hind ones behind), and tarsi ferruginous; mandibles red, dusky apically; clypeus (except two small dusky spots) and labrum reddish orange, but almost certainly yellow in life; supraclypeal area reddish; antennæ long and slender, red, the flagellum suffusedly blackened above and broadly black apically; hair of face, front, vertex, and thorax above very rich orange-ferruginous, that on scutellum and posterior two-thirds of mesothorax tipped with fuscous; second s.m. sometimes narrower, when it receives first r.n. before middle; hair-bands of abdomen thin, pale fulvous, inconspicuous.

Hab. Yallingup, S.W. Australia; both sexes, Nov. 1913, and a female, Dec. 1-12 (*R. E. Turner*). British Museum.

The sexes look very different, but they were associated by the collector, who determined them to belong together by field-observations.

The species is allied to *P. nigrocinctus*, Ckll., but readily distinguished by the large size and bright colours. Mr. Turner has determined that *P. tenuicinctus*, Ckll., is the male of *P. nigrocinctus*; he found the sexes together abundantly on *Leptospermum*. The type of *P. callander* is a female.

Paracolletes andreniformis, sp. n.

♀.—Length about 13 mm.

Robust, black, with black and white hair; head broad, facial quadrangle much broader than long; cheeks and lower half of front with long white hair, at sides of face it is thin and greyer, on vertex it is fuscous, beneath labrum it is glittering golden; mandibles truncate; clypeus shining, sparsely and irregularly punctured, raised in the middle to a roof-like ridge; supraclypeal area shining, rather more closely punctured than clypeus; scape long and black; flagellum short, dull reddish beneath except basally; sides of front finely, rather closely punctured; thorax with white hair in front and behind, at sides and beneath, dense on tubercles, but mesothorax (except anteriorly) and scutellum with thin black hair; mesothorax and scutellum polished and shining, with distinct but not dense punctures; area of metathorax smooth and shining, the margin beaded; pleura dullish, punctured; tegulæ very dark brown, with a tuft of black hair in front. Wings dusky, nervures and stigma

picuous; b. n. meeting t.-m. on outer side; second s.m. only moderately broad, receiving first r. n. about middle; end of first r. n. about twice as far from second t.-c. as second r. n. from third t.-c. Legs with fuscous to cream-coloured hair, largely fuscous on outer side of anterior and middle tibiae, but hind tibial scopa cream-coloured or very pale brownish. Abdomen very finely and closely punctured, segments 2 to 4 with interrupted white hair-bands, apical half of fifth densely covered with ochreous hair, and the sixth with the same; apical plate narrow and rather small; apical half of venter covered with appressed golden hair.

Hab. Yallingup, Dec. 23, 1913-Jan. 23, 1914; 3 ♀ (*R. E. Turner*). British Museum.

In my table of Smith's species this falls nearest to *P. obscurus*, which has sooty-black hair on the fifth abdominal segment. Superficially it is very like certain species of *Andrena*.

Goniocolletes pallidus, sp. n.

♂.—Length about 11.5 mm.

Agreeing in structure and most characters with *G. morsus*, Ckll., the type of the genus, but having the abdomen light ferruginous (hind margins of segments broadly hyaline), with the punctures very fine and the mesothorax feebly punctured. The pygidial area on seventh tergite of abdomen and the projecting apical plate beyond are red. The flagellum is dusky red, almost black above. The third s.m. is broad above and the third t.-c. is strongly bowed outward. Hind tibiae with approximately apical half black and basal half orange-fulvous. Maxillary palpi short.

Hab. Hermannsburg, Central Australia (*H. J. Hillier*). British Museum.

The second known specimen and species of this remarkable genus.

Callomelitta rugosa, sp. n.

♀.—Length about 8 mm.

General form as in *C. picta*; head and thorax with scanty, short, pale reddish hair; head black, with the lower margin of clypeus, labrum (which is emarginate), and mandibles (which are thick, bidentate at apex) obscure dark red; antennae entirely bright ferruginous; entire head strongly and quite closely punctured; mesothorax terra-cotta red, except a large black patch in the posterior middle, the whole appearing rugose from the strong and very dense punctures;

tubercles red, strongly carinate, covered behind with dense cream-coloured tomentum; rest of thorax black; scutellum very coarsely rugoso-punctate, postscutellum dull and granular; area of metathorax with a row of plicæ at the base and one on each postero-lateral side, the latter broad at the sides, but toward the middle narrowing to a line of pits; sides of metathorax, as seen from behind, with only a single projecting point, but there are two nodules on each side near the upper corners, only noticed in an oblique view; pleura coarsely rugoso-punctate; tegulæ light fulvo-ferruginous. Wings strongly smoky, paler basally; stigma and nervures rufo-fuscous; venation essentially as in *C. picta*, but first r. n. joins second s.m. well beyond the middle, and third s.m. is less contracted above. Legs ferruginous, hind tibia with a loose white scopa; hind tibial knee-plate greatly elongated, hind spur with only a microscopical ciliation. Abdomen black, with the base and apex of first segment and second segment almost entirely dull red; first segment polished and shining, with very sparse minute punctures; second shining, but closely and distinctly punctured except in middle; remaining segments closely and finely punctured, but clothed with fine and short, appressed, golden-brown hair, the apical region with long pale reddish hair.

Hab. Queensland (*F. P. Dodd*). British Museum. The exact locality is unknown.

Nearest to *C. turnerorum*, Ckll., also from Queensland, but easily known by the colours, the rugose sculpture, &c.

Prosopis kalamundæ, sp. n.

♀.—Length about 7·5 mm.

Head and thorax black, with bright chrome-yellow markings, consisting of large lateral face-marks (filling space between clypeus and eye, and extending upward with the form of a closed hand with the index-finger, which is very short, pointed), swollen upper border of prothorax, tubercles, large semilunar patch behind tubercles, scutellum, and postscutellum (except at sides). Legs black, the anterior tibiæ with an obscure yellow spot at base. Abdomen shining steel-blue; clypeus aciculate, somewhat depressed in middle; front and vertex shining, with strong well-separated punctures; mesothorax shining, with large, irregular, scattered punctures; area of metathorax with a basal channel crossed by plicæ, and below this, on each side, a strong oblique ridge; pleura with widely separated punctures. Legs with fine silky white hair; tegulæ black.

Wings quite clear, stigma and nervures fuscous; first r.n. meeting first t.-c. Abdomen shining, with extremely feeble and minute scattered punctures.

♀.—Variety *jugata*, v. n. With a transverse approximately kidney-shaped supraclypeal mark, the notch on the lower side; a yellow spot near each anterior corner of mesothorax, and a yellow dot on tegulae. The clypeus is obscurely reddish.

Hab. Kalamunda, S.W. Australia, Feb. 9–28, 1914 (*R. E. Turner*). British Museum.

In my table of Australian *Prosopis* this runs to 18, and runs out because it is much smaller than *P. perplexa*, and has a yellow patch behind tubercles. Mr. Turner obtained males of *Prosopis elongata*, Smith, at Kalamunda; superficially *elongata* much resembles the new species, but on closer examination it is seen not to be very closely allied.

Prosopis fulvicornis, Smith.

Kalamunda, Feb. 9–28, 1914; 1 ♂ (*R. E. Turner*).

This agrees with Smith's description of *P. fulvicornis* (which was discovered from the Baly collection, and was not in the British Museum), except for the fact that the lateral face-marks extend broadly halfway up the front, so that the whole yellow area of the head rather resembles (though too broad) a donkey's head with erect ears. The large and broad supraclypeal mark is notched above; the yellow mark behind the tubercles is crescentic. Smith's short description is otherwise very characteristic.

This falls nearest to *P. purpurata*, Sm., but is smaller, and differs in some details of the markings. It cannot be the male of *P. kalamundæ*, the sculpture being entirely different.

Pachyprosopis hæmatostoma, Cockerell.

Kalamunda, Feb. 9–28, 1914 (*R. E. Turner*); 3 ♀.

With these are sent two males of *P. aurantipes*, Ckll., with the same data; and if I do not mistake the meaning of the label on one of the *P. hæmatostoma*, it is to be understood that the two are sexes of one species. If this is correct, it is very remarkable, as they differ extremely in colour and general appearance. The *P. hæmatostoma* are duller, not so blue as the original types.

Pachyprosopis flavicauda, Cockerell.

Mt. Wellington, Tasmania, Jan. 15–Feb. 6, 1913, 1300–2300 ft. (*R. E. Turner*). British Museum.

A surprising extension of range; the species was described from Sydney.

Euryglossa pauperula, sp. n.

♀.—Length about 3·75 mm.

Black, shining, the abdomen above obscurely purplish; head thick, rather large, subquadrate, with broad cheeks; mandibles cream-colour, with black apex, which is bidentate; labrum and the very broad and low clypeus yellow, the latter with a pair of widely separated fuscous teeth on lower margin; antennæ brown, flagellum hairy, scape with a light stripe in front; tegulæ brown. Wings hyaline, with a very large dull rufous stigma; first r. n. joining first s.m. about as far from apex as equal to half first t.-c.; second s.m. about as broad (long) as its apical height, not greatly produced above apically. Legs fuscous, with the trochanters very pale reddish, the femora piceous, the anterior tibiæ pale red in front, all the tarsi pale fusco-ferruginous. Abdomen broad, not hairy. The head and thorax are microscopically reticulate, with scattered minute punctures.

Hab. Yallingup, S.W. Australia, Oct. 16, 1913; 1 ♀ (*R. E. Turner*). British Museum.

This might be considered a *Pachyprosopis*, and is only placed in *Euryglossa* because it lacks the true *Pachyprosopis* venation. From its minute size, it will be associated with *E. pernana*, Ckll., but it differs at once by the yellow clypeus, large stigma, &c.

Euryglossa narifera, sp. n.

♀.—Length scarcely 5 mm.

Robust, shining, head and thorax black, abdomen obscure purple; head large and broad, extremely thick, without hair, except a thin fringe of long pale brown hairs over mouth; lower part of cheeks with a large pale yellow patch; mandibles light ferruginous, black apically; labrum ferruginous; clypeus (except two large semicircular areas, looking like nostrils, on lower margin), a transverse supraclypeal bar, and linear lateral face-marks (running along orbits to level of antennæ) all pale yellow; antennæ short, light ferruginous beneath; tubercles light yellow; tegulæ testaceous. Wings hyaline, stigma (which is large) and nervures

dark rufo-fuscous; b. n. greatly arched; first r. n. meeting first t.-c.; second s. m. broad, but its upper apical corner produced. Legs light ferruginous, the femora marked with piceous, the anterior femora almost wholly dark except at extreme ends. Abdomen broad, pale reddish at extreme apex and beneath.

Hab. Yallingup, S.W. Australia, Nov. 1913, 3 ♀ (*R. E. Turner*). British Museum.

Perhaps better called *Pachyprosopis narifera*, but the second s. m. is not of the extreme type characteristic of *Pachyprosopis*. The species is allied to *E. paupercula*, but much larger, with different markings.

Euryglossa nigrocærulea, Cockerell.

Mt. Wellington, Tasmania, 1300–2300 ft., Jan. 15.–Feb. 6, 1913 (*R. E. Turner*).

New to Tasmania.

Euryglossa flavocuneata, sp. n.

♀.—Length about 8 mm.

Similar to *E. undulata*, Ckll., but differing thus:—Much smaller; apical part of abdomen light ferruginous, with hair of the same colour; mandibles sometimes with a pale yellow stripe above on basal half; flagellum beneath reddish brown, without bands or spots; scutellum wholly without a median impressed line; tegulæ pellucid reddish testaceous. Wings strongly infuscated; b. n. falling short of t.-m. Middle tibiæ with a broad yellowish stripe in front, sometimes obsolete; hind knees pallid. First abdominal segment with more than basal half yellow, more or less marked with pale reddish; fifth segment pale red, flushed with yellow at base, sixth red. The abdomen has six conspicuous cuneiform yellow patches, representing the bands on segments 2 to 4. The type has a very broad abdomen; in the other two it appears narrow, but evidently as the result of compression in papers. The head and thorax are black, without pale markings.

Hab. Yallingup, S.W. Australia, Nov. 1913 (*R. E. Turner*). British Museum.

Had I received only the male of *E. undulata*, with females of *E. flavocuneata*, I should have referred them without hesitation to a single species. Fortunately the sexes of *undulata* were taken mated; the male of *flavocuneata*, when found, will resemble that of *undulata*, presumably differing by the darkened wings and testaceous tegulæ.

Euryglossa platyrhina, sp. n.

♀.—Length about 6.5 mm.

Very broad, with thin white hair, long on cheeks, pleura, sides of metathorax, and sides of abdomen beneath; dense hair fringing tubercles brownish white; head and thorax black, without pale markings, except that the depressed and flattened clypeus is pale yellowish ferruginous (the margins and upper corners variably fuscous), and this colour may extend to form a transverse supraclypeal band; abdomen dull, light ferruginous, with the following conspicuous black or piceous marks:—a broad transverse band on middle half of first segment, a large subcircular patch on each side of second, a very broad band on middle third of second, a transverse patch on middle of third, and a slight shade on fourth; mandibles dark, very obscurely rufescent just before apex; labial palpi peculiar, first joint greatly swollen, largely piceous, second about half as wide as first, piceous except at ends, about twice as long as wide, third and fourth pale ferruginous, long and slender, the fourth longest (about 225 microns); maxillary palpi extremely small, six-jointed, the basal joint dark, the others pale ferruginous; clypeus dullish, with very sparse and minute punctures; front dull, with small scattered punctures; cheeks very small, the whole head remarkably flat; scape and flagellum pale reddish testaceous beneath; mesothorax dull, with widely scattered very small punctures; scutellum more shining; area of metathorax smooth and shining; tegulæ hyaline. Wings hyaline, faintly dusky, stigma and nervures dull ferruginous; b. n. falling some distance short of t.-m.; first r. n. joining second s.m. near base; second s.m. broad, second t.-c. regularly arched outward. Legs hairy, black or piceous and ferruginous, the basal third and anterior sides of anterior and middle tibiæ, anterior and middle knees, hind tibiæ entirely, and greater part of hind femora ferruginous; middle femora broad, convex in profile below; hind spurs of hind tibiæ with two rows of short strong tooth-like spines. Pygidial plate of abdomen very small.

Hab. Yallingup, Dec. 23–Jan. 14, 1913–14 (*R. E. Turner*); 3 ♀. British Museum.

A peculiar and distinct species, not a typical *Euryglossa*. It could be made the type of a distinct genus or subgenus, but this may wait until the classification of the whole group is reconsidered.

XXXI.—*On some of the External Characters of Cynogale bennettii, Gray.* By R. I. Pocock, F.R.S., Superintendent of the Zoological Society's Gardens.

[Plate XIV.]

SOME of the external features of this aberrant amphibious civet have been often described. Nevertheless, several interesting points have been overlooked, and many of the published statements regarding the characters observed require amplification or correction, the shortcomings in question being to a great extent attributable to the enforced dependence of authors upon dried skins or upon material defective in other ways.

The matter contained in this paper is based mainly upon an examination of three specimens, an adult female and two young, collected by the late Mr. A. Everett in N.W. Borneo and preserved in alcohol in the British Museum*.

Colour.—Accounts of the colour of *Cynogale bennettii* are discrepant. In his very brief original description, published in 1836, Gray said nothing on this point, but in the following year he described the colour as brown, with the elongate rigid hairs, rising from the soft crisp fur, black, with a "subterminal silver-white band." This was confirmed by Eydoux and Souleyet, who, in 1841, wrote:—"Les poils soyeux, qui sont surtout apparents au dos, dépassent un peu ceux de la bourre, et comme ils sont terminés de blanc, ils donnent au pelage une teinte générale glacée."

Similarly, Schlegel and Müller (Zoog. Ind. Archipel, p. 120, 1839) described the species as "donkerbruine witachtig gespikkelde kleur"—that is to say, colour dark brown, speckled with whitish.

Flower and Lydekker (1891) copied Gray in recording the fur as dark brown mixed with black and grey.

Finally, Sányál wrote of a specimen living in the Gardens at Calcutta (P. Z. S. 1894, p. 296):—"Prevailing colour of the fur grey, becoming grizzled white on the back, rump, and outer surface of the limbs."

On the other hand, Mivart, in 1882, said the colour of the coat is red-brown, with no markings, save a very narrow black line along the crown of the elongated head; and,

* This paper is published by permission of the Trustees. On this, as on other occasions, I am indebted to Mr. Oldfield Thomas for untrammelled access to the specimens under his charge.

following him apparently, Blanford, in 1888, spoke of the colour as red-brown.

Detecting the discrepancy between Mivart's and Sányál's accounts, Mr. Lydekker, in 1896, commented on it as follows:—"The colour has been hitherto described as uniformly reddish brown, save for a narrow dark streak down the head. The difference may, perhaps, be in part accounted for from the fact that one description is taken from the living animal and the other from dried skins, and also from the different ages of the specimens examined, old ones being probably more grey than younger examples."

The main part of this passage is hardly in accord with the facts, for the original authors—Gray, Schlegel and Müller, Eydoux and Souleyet—independently mentioned the white speckling; and although Gray, at all events, had only a dried skin to go upon, and the French and Dutch authors certainly never saw *Cynogale* alive, their descriptions nevertheless agree, at any rate in recording the white speckling, with that of Sányál, who had a living specimen before him.

All the adult and subadult specimens in the British Museum, ranging from Malacca to Borneo, resemble in colour those described by Gray and by the French and Dutch authors. They are very dark brown, frosted with grey above. The whitish speckling scarcely extends on to the tail and legs, and is absent on the underside, which is paler brown than the back. The rhinarium is flesh-coloured and the upper lip, lower lip, chin, and a varying amount of the interramal area and of the upper end of the throat are pale. There are two white spots on each cheek, marking the position of the genal vibrissal tufts, which are white, like those of the interramal tuft. Similarly, the vibrissæ arising from the pale area of the upper lip are white. The uppermost of them, however, are black, as also are the superciliary bristles.

Mivart's silence on the subject of the grey speckling suggests that his description of the colour was written from memory. At all events, it is quite misleading.

Sányál's description fits none of the specimens exactly. His example, from an unknown locality in Borneo, was clearly much whiter than any seen by other authors; but since it is not available for examination, even if preserved after death, it is useless to do more than suggest the possibility of its having been a very old animal or a partial albino. In this connection, be it noted, the tip of the tail was described as white. At the same time it must not be forgotten that the

underside was described as blackish, and was therefore darker, instead of lighter, than the upperside. But since his notes were taken from a living specimen, it is possible that the blackish appearance of the underside was due to its being in shadow.

As regards the colour of the young, Cantor (J. A. S. B. xv. p. 203, 1846) wrote of Malayan specimens:—"The very young . . . differ from the adult in having a very soft, silky, dense fur, mixed with longer hairs, which are black except on the chest and abdomen, where the apex is silvery. Over the tarsus and the upper surface of the feet some of the hairs have a terminal white band close to the black apex. The posterior margin of the ear is hairy and of a silvery colour." Since an adult specimen from Malacca sent by this collector to the British Museum is speckled with grey dorsally, it may be inferred that the absence of dorsal speckling is the main distinctive chromatic feature of the newly-born young.

On the other hand, the two young specimens from N.W. Borneo in the British Museum differ from their mother in having no appreciable white speckling above; but, as in the adult, there is no such speckling below. These specimens, in fact, bear out Mr. Lydekker's suggestion that the greyness increases with age—at all events, up to a certain point.

*Muzzle and rhinarium** (Pl. XIV. figs. 1, 2).—The muscular development of the lateral portions of the upper lip, to give mobility to the mystacial vibrissæ, imparts a singular aspect to the head, when viewed from above or below, owing to the demarcation of the muzzle from the area behind it by a deep constriction on each side.

Another peculiarity of the muzzle, to which attention has been drawn by Mivart and others, is the absence of a median vertical groove cleaving a central naked strip of integument, such as is seen passing from the rhinarium to the edge of the upper lip above the incisor teeth in the majority of Carnivores and all typical Viverrines. But that is not all. This area of the upper lip, in addition to being continuously hairy and provided with short vibrissæ, is also of unusual length or depth. It differs, indeed, from the corresponding area in all *Æluroid* Carnivores, let alone the Viverrines and Paradoxurines, and not excepting *Crossarchus obscurus*, in being about twice the height of the anterior vertical portion

* For an account of the muzzle, feet, and glands of the typical Viverrines, see my paper, P. Z. S. 1915, pp. 131-149.

of the rhinarium, when viewed from the front. And this disproportion results not only from the deepening of the upper lip, but from the concomitant expansion of its upper half, so that the major portion of the rhinarium is, as it were, thrust or tilted up to occupy a horizontal position, with the nostrils opening upwards on the summit of the muzzle. This modification is quite unique amongst the *Æluroidæ*, and its importance is not lessened by explaining it as an adaptation to aquatic life.

The *rhinarium* itself is peculiar in other respects when compared with that of Viverrine and Paradoxurine Carnivores, though recalling the rhinarium of some genera of the latter category in the nearly horizontal extension of its inferior border and the deep median groove marking its anterior surface and the fore part of its upper surface. The infra-narial portion of its anterior surface is, however, very shallow or short; and from its widest part above, the lateral margins of the rhinarium are strongly inclined inwards and backwards, so that its slightly concave posterior border just behind the posterior notches of the two nostrils is less than half its greatest width. The nostrils themselves are long, and conform in shape to the curvature of the lateral border of the rhinarium. Externally they are bordered by the thickened rim of the rhinarium, and this thickening is carried round their narrowed posterior portion on to the inner or ad-median side. Their appearance suggests that they are strongly valvular for the exclusion of water.

Vibrissæ.—The thickness, length, and abundance of the facial bristles have attracted attention from the first, but they have not always been accurately described. Mivart, for example, says there is a bunch below each ear. This is repeated by Sányál, who adds that there is an intermediate set on each side of the nose between the eye and the lip. As a matter of fact, the tufts of vibrissæ are typically Carnivorine both in number and position: that is to say, they resemble in those respects the vibrissæ of all the Cynoid and most of the *Æluroid* and *Arctoid* Carnivores, and belong to the following categories—mystacial, submental, superciliary, interramal, and genal (Pocock, P. Z. S. 1914, p. 901). The upper genal tuft is in front of the base of the ear and the lower some distance behind the corner of the mouth. Neither of the two genal tufts on each cheek is below the ear, and the “intermediate set” mentioned by Sányál are the uppermost bristles of the mystacial series.

The *carpal vibrissæ* are absent, an unusual feature in this group of Carnivora.

Ear (Pl. XIV. fig. 3).—The pinna, as described by others, is small, but its upper margin is slightly angular, not evenly rounded as stated by Sányal. The cartilaginous ridges and flaps round and above the meatus resemble closely in a general way those of *Genetta*, as described and figured by Mivart (P. Z. S. 1882, p. 517, fig. 12). The "antitragus" is well developed and "double," as Mivart says—that is to say, there is an upstanding crest on its inner side, with a fossa between. Similarly, the anterior basal ridge of the "helix" forms a ridge on the inner side of the "tragus," and is separated from it by a fossa. Above these lies the longitudinal crest called the "supratragus" by Mivart, the "*plica principalis*" by Boas, the "antihelix" by other writers; the lobate thickening of this is not well developed.

Finally, the posterior marginal pouch or *bursa*, well known in Canidæ and Felidæ and described by Mivart in *Genetta*, is present, but its anterior edge is only lightly concave and its posterior edge is continuous above with the posterior margin of the pinna, and does not arise behind it.

When the ear is contracted to exclude water, the meatus is closed by the "dovetailing" of the ridges in front and behind it, the antitragus fitting into the fossa between the tragus and the lower or proximal ridge of the helix, and the latter into the fossa between the outer and inner moieties of the double antitragus.

Mammæ.—There are two pairs of abdominal mammæ, as in *Paradoxurus*, one pair set forwards a little behind the position of the diaphragm and the other towards the inguinal region on a level with the anterior junction of the integument of the thigh with that of the body.

As regards the number of young, the only available information, so far as I am aware, is that supplied by Cantor, who had two with the mother. Since there are also two with the female collected by Everett, it is safe to assume that that is the average number in the litter, though the teats afford provision for four.

Feet (Pl. XIV. figs. 4, 5).—Descriptions of the feet of *Cynogale* attest the belief that the digits, in conformity with the aquatic life of the animal, are provided with swimming-webs, while those of its *Paradoxurine* allies are unwebbed. The growth of this belief is a curious instance of the result of copying and repeating extant descriptions, with the addition thereto of obvious inferences, without a check being put upon the statements by reference to actual specimens.

Although in his original description of *Cynogale* (P. Z. S. 1836, p. 88) Gray said nothing about the feet, he subse-

quently described the toes as "half-webbed" (Charlesworth's Mag. Nat. Hist. i. p. 579, 1837). Again, Eydoux and Souleyet (Voy. de la 'Bonite,' i. p. 27, 1841) wrote:—"Ses doigts sont palmés antérieurement et postérieurement, mais ils sont peu allongés." Later, Gray (P. Z. S. 1864, p. 521, and Cat. Carn. Brit. Mus. p. 78, 1869) described the toes as "being short, covered with dense hairs and slightly webbed at the base"; and certainly his omission to mention the webs on the feet of other Paradoxurine civets justifies in a measure the conclusion that the webs are peculiar to *Cynogale*.

This conclusion was apparently drawn by Mivart, when he wrote (P. Z. S. 1882, p. 172):—"Its webbed feet, short tail, long moustaches, together with its exceptional upper lip, serve, however, to mark it as a very distinct genus." Blanford ('Mammalia of British India,' 1888, p. 119) also referred to the webbed feet as a peculiarity. Flower and Lydekker, however ('Mammalia,' 1891, p. 535), with more caution, repeated verbatim Gray's description of 1864: "Toes short, slightly webbed at base"; but the second of these two authors ('Handbook to the Carnivora,' 1896, p. 242) introduced for this animal the trivial title "The web-footed Civet," and in his diagnosis of it said:—"This genus may be easily recognized by the absence of a vertical groove on the upper lip, the short tail, the partially webbed feet, and by the under surface of the tarsus and metatarsus being rather less naked than in the Palm-Civets"—this last item being derived from Mivart's description of 1882.

A knowledge of the facts enforces the conclusion that the authors quoted never compared the feet of *Cynogale* with those of its nearest allies, all of which, like most Carnivores, have the digits webbed up to the proximal end of the digital pads. An inspection of the feet even on a dried skin of *Cynogale*—from which the figure of the hind foot published by Mivart in 1882 seems to have been taken—shows clearly that the webs do not extend farther up the digits than is the case in *Paradoxurus*, for example. More than that, I find that in the above-mentioned example in alcohol in the British Museum the ends of the digits project farther beyond the webs than in any genus of Paradoxurines known to me. The webs do not reach the proximal margins of the digital pads either in the fore foot or in the hind foot; but what the webs lose in depth they gain in breadth. They are broader than in any other Paradoxurine or Viverrine genus, and the digits are capable consequently of wider lateral expansion. In that sense, and that only, are the feet

more webbed than in related genera. But if *Cynogale* were known only from its feet, the amphibious habits of the genus could not be safely inferred from their structure.

The oft-repeated statement that the digits are short is not true, if by that is meant that they are shorter than in allied forms. The pollex and the hallux are relatively longer, and the remaining digits are certainly not shorter, than in other genera of this group.

As regards the nakedness of the soles of the feet, there is little, if anything, to choose between those of *Cynogale* and of *Paguna* or *Paradoxurus*. Broadly speaking, the feet are essentially Paradoxurine, as opposed to Viverrine, in the matter of nakedness—that is to say, in the hind foot the heel (tarsus) only is hairy, the whole of the underside of the metatarsus and the area surrounding the plantar pads being naked. Similarly, in the fore foot the naked area of the carpal pads is as wide and nearly as long as the plantar pad, and there is no hair anywhere between the edges of the webs and the posterior border of the carpal pads. In both fore and hind feet the lobes of the plantar pads are well developed and well defined by grooves from each other, the pollical and hallucal lobes being large. On the fore foot the external or ulnar carpal pad forms a large prominent upstanding ridge. The inner or radial element lying behind the pollical lobe of the plantar pad is, on the contrary, scarcely detectable. On the hind feet there are only very indistinct and broken ridges lying on each side of the metatarsus behind the plantar pad. On both fore and hind feet the pads themselves, as well as the adjacent naked integument, are, comparatively speaking, smooth.

The claws are not nearly so strongly curved as in the typically arboreal Paradoxurines, are imperfectly retractile, and are unguarded by skin-lobes or hairs at the base.

As in most Carnivora, the fore foot is broader than the hind foot.

The scent-gland (Pl. XIV. figs. 6, 7, 8).—With regard to this organ, Mivart wrote in 1882 :—"I can find no record as to the existence of any prescrotal gland or as to the condition of its anal region." I am not aware that the gland has been described, but it is unmistakably present in the adult female example above mentioned.

The region of the anus and the vulva is covered by a continuous area of naked skin, irregularly piriform in outline. The vulva is at its anterior and the arms at its posterior end. The former orifice is considerably closer to the latter than

in the majority of Paradoxurines, but not in all, and the vulval area is defined from the anal and glandular area by a shallow marginal constriction of the naked integument. Almost midway between the anus and the vulva there is a pair of small pits or depressions in the skin, each of which was plugged with a hardened piece of amber-like secretion. These pits are shallow, and individually are smaller than the orifice of the vulva. Immediately behind them there is a shallow transverse crease in the integument; but the glandular area, as a whole, is in no sense invaginated or provided with distinct upstanding labia.

In the young female the subcircular anal area is more sharply defined from the vulval area, the marginal constriction being deeper, and the glandular orifices are sunk in a short transverse depression passing across the naked field from angle to angle of the constriction.

In the young male the penis is elongated and distally pendulous, an unusual feature in the Paradoxurine group. It is hairy at the sides, more sparsely hairy below, but naked round the prepuce. Passing backwards from the base of the penis between the two halves of the scrotum to the naked circumanal area there is an elongated naked tract of skin showing in the middle line traces of three shallow depressions, which are probably incipient glandular pits. This division of the scrotum into two quite distinct, somewhat widely separated testicular sacs is a very curious character. That it persists in the adult, however, is quite clearly shown on one of the skins in the British Museum, namely, the type described by Gray, which, furthermore, appears to have been provided with a naked glandular area like that of the young.

The anterior of the three median glandular pores above described is very small and close to the base of the penis. The posterior, which is considerably larger, lies nearly opposite the middle of the two halves of the scrotum. The intermediate, a little more conspicuous than the posterior, and, like it, surrounded by a low integumental rim, is situated about midway between the other two.

This discovery of the scent-glands in *Cynogale* fully explains the following passage in Sányál's account of a living specimen, and substantiates the truth of the claim made therein:—"The presence of a strong civet-like smell near its cage, especially at night, unmistakably indicates the possession of odoriferous glands" (P. Z. S. 1894, p. 297).

From the foregoing account it will be clear that the glands of this animal are of a very simple type. They are simpler, indeed, than the glands of any Paradoxurine known

to me that possesses these organs. But whether the simplicity is to be assigned to degeneration connected with the aberrant habits of the animal, or whether it is to be regarded as primitive and as indicating an early stage in the evolution of the glands, we shall, perhaps, never know.

Inferences as to Mode of Life.—The records relating to the mode of life of *Cynogale* were summarized by Flower and Lydekker as follows:—"This is a curious otter-like modification of the Viverrine type, having semi-aquatic habits, both swimming on the water and climbing trees, living upon fish, crustacea, small mammals, birds, and fruit." This summary may, I think, be amplified by a few inferences, justified by some of the structural features above described.

The formation of the feet, with their naked soles and sharp partially retractile claws, confirms the testimony as to the climbing powers of the animal; but the shortness of the tail suggests inferiority to the so-called palm-civets (*Paradoxurus*, *Nandinia*), binturong (*Arctictis*), etc., in scansorial skill and activity. On the other hand, as compared with the otters, which, by reason of their long, loosely knit, widely webbed toes, supplied with comparatively weak claws, are but indifferent climbers, *Cynogale* is probably a slow swimmer, without the faculty of rapid turning in the water. These defects in aquatic agility are suggested particularly by the shortness and the absence of special muscular power in the tail, and to a lesser extent by the narrowness of the hind feet and the feeble development of their interdigital webs. The inability of *Cynogale* to overtake swift-swimming fishes under water may, therefore, be tolerably safely assumed.

The teeth, especially the premolars, nevertheless, seem clearly to be adapted for seizing and holding slippery wriggling prey of that description, rather than for crushing the hard shells of freshwater crabs or molluscs, although the molars are doubtless capable of performing that office. Hence it may be supposed that most of the fishes preyed upon are captured after they have taken shelter from the chase under the edge of a submerged rock, in crevices between large stones, or in holes in the banks or the bed of streams. This supposition is borne out by the unusual development of the facial vibrissæ, not only upon the upper lip, but upon the cheeks, over the eyes, and underneath the jaw as well. Having watched the retreat of a fish to its place of refuge, *Cynogale*, I imagine, paddles quietly to the spot to seize its prey while lying low, with its movements hampered in the confined space—a predatory device frequently practised by otters. The thickness of the vibrissæ, as in the case of other

piscivorous Carnivora, naturally keeps them erect and functional in the water, and their increase in length and number supposedly enables *Cynogale* to thrust its head with safety into the lurking-place of its prey, and to ascertain with accuracy the shape and size of the space, while a further function of the mystacial tufts is to supply information as to the exact whereabouts of the hiding fish or crab or mollusc, if these invertebrates form, as perhaps they do, a portion of its usual diet.

From the upward aspect of the nostrils—a character in which these orifices surpass those of otters and seals,—it may be inferred that *Cynogale* is in the habit of lying submerged with only the tip of the nose exposed above the surface. Since concealment under water can hardly be for the purpose of protection from enemies, its object may be assumed to be predatory; and it may be suggested that the modification in question—unique in its extent, I believe, in the Carnivora—is of service to *Cynogale* when lying in wait near the bank of a stream for small mammals or birds that may frequent the banks or come to drink.

If this be the correct interpretation of the facts, it helps us to understand the restriction to the head of practically all the evidences of the amphibious habits of *Cynogale*.

EXPLANATION OF PLATE XIV.

- Fig. 1.* Muzzle and rhinarium from above, showing the horizontal and dorsal position of the nostrils. The vibrissæ of the left side omitted, those of the right mostly cut short.
- Fig. 2.* The same from the front, the vibrissæ omitted.
- Fig. 3.* The base of the ear. *tr.*, tragus; *a.tr.*, antitragus; *a.h.*, antihelix (supratragus); *b.*, bursa.
- Fig. 4.* Left fore foot from below. 1 and 5, first and fifth digits.
- Fig. 5.* Left hind foot from below. 1 and 5, first and fifth digits.
- Fig. 6.* Anal and genital area of adult female. *a.*, anus; *gl.*, orifice of perfume-gland; *v.*, vulva.
- Fig. 7.* The same of immature female.
- Fig. 8.* Anal and genital area of immature male. *a.*, anus; *s.*, one sac of scrotum; *gl.*, supposed pores of perfume-gland; *p.*, penis.

XXXII.—On the Genera *Eglisia*, *Callostracum*, *Mesalia*, *Turritellopsis*, and *Tachyrhynchus*. By EDGAR A. SMITH, I.S.O.

MOST of the species referred to in this paper have been referred to *Turritella*, *Eglisia*, or *Mesalia*, some rightly located, others incorrectly.

It was thought, therefore, it might be useful to bring together a list of the described species, giving rather numerous references, and to assign these various forms to what appears to be their true generic position.

It is unfortunate that the animals of *Eglisia* and of the type of *Mesalia* are unknown, and consequently it cannot be stated with certainty whether their relationship is nearest to the Turritellidæ or Epitoniidæ.

EGLISIA, Gray.

1840. *Eglisia*, Gray, Synopsis Contents Brit. Mus. 1840, p. 147 (name only).
 1842. *Eglisia*, id. *op. cit.* ed. 44, p. 61 (name only).
 1847. *Eglisia*, id. Proc. Zool. Soc. 1847, p. 155. For *Turbo suturalis* (Gray), Wood.
 1849. *Eglisia*, Reeve, Conch. Icon. vol. v.
 1854. *Eglisia*, H. & A. Adams, Genera Rec. Moll. vol. i. p. 354.
 1857. *Eglisia*, Gray, Guide Moll. Brit. Mus. p. 110.
 1859. *Eglisia*, Chenu, Man. Conchyl. vol. i. p. 318, as subgenus of *Turritella*.
 1852. *Eglesia* (sic), Sowerby, Conch. Man. p. 149.
 1878. *Eglisia*, Kobelt, Illust. Conchyl. p. 138.
 1883. *Eglisia*, Tryon, Struct. Syst. Conch. vol. ii. p. 224.
 1885. *Eglisia*, Fischer, Man. Conch. p. 778.
 1887. *Eglisia*, Tryon, Man. Conch. vol. ix. p. 51.

The first description * of this genus is that given by Reeve, but its institution should date from 1847, in which year Gray associated with it the *Turbo suturalis* of Wood, but unaccompanied by any description. Nothing is known of the animal, or hitherto of the operculum, and consequently its systematic position could not be determined. It has been placed in the Turritellidæ by H. and A. Adams, Gray (1857), Chenu, S. Woodward, Kiener, Kobelt, Dunker, Paetel, Boog Watson.

Tryon and Fischer located it in the Epitoniidæ (=Scalariidæ).

In describing *Eglisia cumingii* (= *tricarinata*, Ad. & Rve.) A. Adams remarked:—"The obscure longitudinal varices show the true position of this genus to be between *Turritella* and *Scalaria*." Similar "obscure longitudinal varices" occur in *E. spirata*, the type of the genus, and *lanceolata*, Rve., but they are merely the remains of former outer lips, marking periods of arrested growth, and not, as in *Scalaria*, serving as ribs for the strengthening of the shell. Marks of arrested growth may be observed in some of the Turritellas,

* The few words given by Gray in the 'Synopsis Contents Brit. Mus. ed. 44, p. 61, do not constitute a description, since no species is quoted.

but, being thinner shells, they have the appearance of cracks rather than varices.

The general form of the shells and the spiral liration or carination, and also the coloration, show relationship with *Turritella* rather than with *Epitonium*, and the only conchological difference occurs in respect of the aperture. In *Eglisia* the peristome is distinctly continuous, as in *E. spirata* and *tricarinata*, or the columella is joined to the outer lip by a thin callus as in *lanceolata* and *elegans*. The arched columella also is thickened and reflexed.

In *Turritella* the columella is thin and usually separated from the end of the outer lip. Occasionally, however, a thin connecting callus is present in some species.

Another feature common to all the *Eglisias* is the base of the body-whorl being marked off by a keel and the very fine sculpture upon it, of quite a different character from that on the rest of the shell.

I am now able, through the kindness of Mr. J. R. Le B. Tomlin, who possesses a specimen of *E. spirata* with the operculum *in situ*, to describe that feature.

It is horny, roundly ovate, almost black, and consists of about 3-4 not clearly defined, very rapidly increasing whorls, the pit-like nucleus being markedly excentric. It is slightly

Fig. 1.



concave externally and sculptured with well-marked very arcuate lines of growth. In fact, it closely resembles the opercula of *Epitonium* and *Mesalia*, both of which are paucispiral, and not multispiral as in *Turritella* *.

Eglisia spirata (Sowerby).

1825. *Turritella spirata*, Sowerby, Cat. Tankerville, Appendix, p. xiv.
 1849. *Eglisia spirata*: Reeve, Conch. Icon. vol. v. pl. i. fig. 1.
 1852. *Eglesia* (sic) *spirata*: Sowerby, Conch. Man. p. 337, pl. xxviii. fig. 592.

* Since the above was in type, I have heard from Professor H. M. Gwatkin that, judging from the radula, "*Eglisia spirata* is a clear *Scalaria*."

1854. *Eglisia spirata*: H. & A. Adams, Gen. Rec. Moll. vol. i. p. 354, pl. xxxviii. fig. 5.
 1857. *Eglisia spirata*: Gray, Guide Moll. Brit. Mus. p. 110.
 1859. *Turritella (Eglisia) spirata*: Chenu, Man. Conchyl. vol. i. p. 318, fig. 2287 on p. 317.
 1878. *Eglisia spirata*: Kobelt, Illust. Conchyl. p. 138, pl. xlix. fig. 5.
 1887. *Eglisia spirata*: Tryon, Man. Conch. vol. ix. p. 86, pl. xviii. fig. 58.
 1828. *Turbo suturalis*, Wood, Index Test., Suppl. p. 20, pl. vi. fig. 41.
 1834. *Turritella suturalis* (sic), Sav.; Griffith & Pidgeon, Anim. King. vol. xii. p. 600, pl. xiii. fig. 5.
 1843. *Turritella suturalis*: Kiener, Coq. Viv. p. 26, pl. ix. fig. 1.
 1897. *Mesalia? suturalis*: Kobelt, Conch. Cab., *Turritella*, p. 74, pl. xxi. figs. 6, 7 (after Kiener).

Hab. The Island St. Thomas (*Sowerby*); Mossamedes, Angola (*in coll. J. R. Le B. Tomlin*).

This, the largest species and the type of the genus, is distinguishable at a glance by the whorls being flattened or channelled above in such a remarkable manner.

The geographical distribution of this species has hitherto been uncertain, since the only localities quoted were "The I-land St. Thomas" (*Sowerby*) and Japan (*Kobelt* *). Mr. Tomlin has a specimen, with the operculum, from Mossamedes in Angola, which he obtained direct from that place. It therefore seems fairly certain that *Sowerby's* locality was the St. Thomas Island in the Gulf of Guinea, and that *Kobelt* was wrong in quoting Japan.

In the third edition of *Argenville's 'Conchyliologie'* (1780), pl. xl. fig. J 3, this species is figured, with forms of *Terebra*, *Cerithium*, &c., merely under the general term "Vis" (screw-shells).

Eglisia tricarinata, Adams & Reeve.

1849. *Eglisia tricarinata*, Adams & Reeve; Reeve, Conch. Icon. vol. v. sp. 3, described, but not figured.
 1850. *Eglisia tricarinata*, Adams & Reeve, Zool. 'Samarang,' p. 49, pl. xii. fig. 8 (enlarged).
 1856. *Turritella (Eglisia) tricarinata*: Watson, Gasteropoda 'Challenger,' p. 479.
 1887. *Eglisia tricarinata*: Tryon, Man. Conch. vol. ix. p. 86, pl. xviii. fig. 60 (copy of Ad. & Reeve).
 1898. *Eglisia tricarinata*: Melvill & Sykes, Proc. Malac. Soc. vol. iii. p. 35, pl. iii. fig. 6.
 1850. *Eglisia cumingii*, A. Adams, Proc. Zool. Soc. p. 204; Ann. & Mag. Nat. Hist. 1851, vol. viii. p. 499; Petit, Journ. de Conch. vol. iv. p. 205 (1853).

* Illust. Conchylienbuch, p. 138.

1897. *Turritella leptomita*, Melvill & Sykes, Proc. Malac. Soc. vol. ii. p. 171, pl. xiii. figs. 12, 12 a, vol. iii. p. 35.

1901. *Eggsia leptomita*, Melvill & Standen, Proc. Zool. Soc. 1901, vol. ii. p. 357.

Hab. China Sea (*Ad. & Ree.*); off Malanipa Island, Basilan Strait, Philippines, 10–20 fathoms (*Watson*); Japan (*A. Adams*); Andaman Is. (*Melvill & Sykes*); Persian Gulf and Arabian Sea, west of Bombay (*Melvill & Standen*).

This species is smaller than *E. spirata*, has fewer spiral threads, and the whorls are not tabulated or channelled at the upper part. The figure in the ‘Samarang,’ like others on the same plate, is greatly enlarged, the type being only 28 mm. in length, and that given by Melvill & Sykes in 1898 was taken from Adams’s type of *E. cumingii*. In Dr. J. E. Gray’s collection, preserved in the British Museum, is a still larger specimen, which, if the spire were perfect, would measure 40 mm. in length, and its last whorl is 11.25 mm. in width. It is worthy of notice that even a greater disparity in size occurs in specimens of *Mesalia brevisalis*.

With regard to *E. leptomita*, I have no hesitation in regarding it as identical with *tricarinata*, notwithstanding the remarks offered by Messrs. Melvill, Standen, and Sykes. They observe that “the type has five carinæ at least on the last whorl, and ‘*tricarinata*’ is therefore an inappropriate name.” On reading the original description, it is seen that this character is an allusion to the three principal keels on the upper whorls, and the authors, Melvill & Sykes, employ the same word in the description of *leptomita*. They say that the last whorl is “quadricarinato.” This is incorrect, for an examination of their type shows that there are six carinæ, as described by A. Adams in *E. cumingii*. There are four principal keels, and above these two others, the upper one nearly at the suture, which consequently is channelled.

In the Proc. Zool. Soc., Melvill & Standen observe that “the extremes seem distinct from *E. carinata*, *Ad. & Ree.*, but the species is evidently, though rare, very widely distributed, and intermediates may, in time, be found to occur.” The italics are mine. Since I can discover no differences in *leptomita*, the future need not be taken into consideration.

Turritella conspersa, Adams & Reeve, placed by Tryon as a variety of the present species, is a true *Turritella*, and entirely distinct in every respect.

Protoma pulchrum, Sowerby, from Sierra Leone (Proc.

Malac. Soc. vol. vi. p. 281, fig. 5), has somewhat the general aspect of *E. tricarinata*. It is a true *Turritella*, allied to *T. knysnaensis*, Krauss.

Eglisia lanceolata, Reeve.

1849. *Eglisia lanceolata*, Reeve, Conch. Icon. vol. v. pl. i. figs. 2 a, 2 b.

1859. *Turritella (Eglisia) lanceolata*: Chenu, Man. Conchyl. p. 317, fig. 2288.

1887. *Eglisia lanceolata*: Tryon, Man. Conch. vol. ix. p. 86, pl. xviii. fig. 59 (after Reeve).

Hab. Pasacao, Island of Luzon, Philippines, in sandy mud at a depth of 10 fathoms (Reeve).

To the description given by Reeve it may be added that, besides the "obscure longitudinal varices" which occur irregularly up the spire, the base of the body-whorl is of a uniform darker brown tint than the rest of the shell.

Eglisia elegans, Melvill.

1909. *Eglisia elegans*, Melvill, Trans. Linn. Soc., Zool. vol. xiii. p. 84, pl. v. fig. 7.

Hab. Saya de Malha Banks, Station C 4, 150 fathoms (Melvill).

This locality is situated in the western part of the Indian Ocean, S.E. of the Seychelles Islands.

This pure white shell exhibits at irregular intervals "obscure longitudinal varices" (former lips), and the columella is united to the end of the outer lip by a thin callus.

CALLOSTRACUM, Smith.

Callostracum, Smith, Ann. & Mag. Nat. Hist. 1909, vol. iv. p. 229.

Smithia (preoc.), Maltzan, Nachrichtenblatt deutsch. malak. Gesell. 1883, p. 97, fig.

This genus has been placed in *Eglisia* by Tryon, and considered a section of it by Fischer; but, in my opinion, it should be held distinct, since the character of the aperture is considerably different, and the operculum is described as multispiral, with subcentral nucleus.

Callostracum gracile (Maltzan).

Smithia gracilis, Maltzan, l. c. supra.

Hab. North side of the Island of Goree, Senegambia, West Africa (Maltzan).

The following species have been placed in *Eglisia*, but they do not in reality belong to that genus:—

1. *Eglisia subdecussata* (Cantraine), Fischer, Actes Soc. Linn. Bordeaux, vol. xxvii. p. 115 (1869).

This species is now referred to *Mesalia*.

2. *Eglisia macandrew*, H. Adams, Proc. Zool. Soc. 1865, p. 753.

Regarded as a variety of *Mathilda quadricarinata* (Brocchi), and placed in the Pyramidellidæ. Sacco has created a family Mathildidæ for this genus.

3. *Turritella* (*Eglisia*) *symmetrica*, Hutton, Cat. Marine Moll. New Zeal. p. 30 (1873).

Eglisia symmetrica, id. Journ. de Conch. 1878, vol. xxvi. p. 29.

This is a true *Turritella*.

MESALIA, Gray.

1840. *Mesalia*, Gray, Synopsis Contents Brit. Mus. p. 147 (name only).

1842. *Mesalia*, id. *op. cit.* ed. 44, p. 61.

1847. *Mesalia*, id. Proc. Zool. Soc. 1847, p. 155. For *Turritella mesal*, Desh.

1849. *Mesalia*, Reeve, Conch. Icon. vol. v.

1852. *Mesalia*, Sowerby, Conch. Man. ed. 4, p. 200.

1854. *Mesalia*, H. & A. Adams, Gen. Rec. Moll. vol. i. p. 353.

1857. *Mesalia*, Gray, Guide Moll. Brit. Mus. p. 111.

1859. *Mesalia*, Chenu, Man. Conchyl. vol. i. p. 317.

1878. *Mesalia*, Kobelt, Illust. Conchylienbuch, p. 138.

1883. *Mesalia*, Tryon, Struct. Syst. Conch. vol. ii. p. 224.

1885. *Mesalia*, Fischer, Man. Conchyl. p. 694.

1887. *Mesalia*, Tryon, Man. Conch. vol. viii. p. 193.

As in the case of *Eglisia*, the introduction of this genus must date from 1847, when a species was first associated with it.

Gray (Proc. Zool. Soc. 1847, p. 155) quoted, as examples of his genus, *Cerithium mesal*, Adanson = *Turritella mesal*, Deshayes, a *Turritella* sp., and *T. sulcata*, Lamk. He evidently considered the shell described by Adanson as the type of his genus, since he founded the name upon that species. Jeffreys*, therefore, was quite wrong in stating that "the type of Gray's genus is *Turritella sulcata* of Lamarck, a Grignon or Eocene fossil."

Mesalia may be separated from *Turritella* by certain features

* Proc. Zool. Soc. 1884, p. 132.

in the aperture and the operculum, which is paucispiral, like *Littorina*, and not multispiral, as in *Turritella*.

The figures in Adams (Genera Recent Moll. vol. iii. pl. xxxviii. figs. 4 a, 4 b) represent the operculum of the genus *Turritella*, and not that of *Mesalia*.

This mistake led Dall * into the error of stating that the opercula of *Mesalia* and *Tachyrhynchus* (*Mesalia reticulata*) presented no difference. The fact is, that of the former consists of four or five rapidly enlarging whorls with a somewhat excentric nucleus, whereas that in the latter genus is multi-spiral, with central nucleus.

The opercula of typical examples of *M. brevia*lis, from Goree, in the British Museum, are almost black, rather concave externally in the dried state, and consist of four or five

Fig. 2.



rapidly increasing volutions, somewhat carinate at the suture towards the deep nucleus, and with a raised spiral thread upon them which does not extend to the last two large whorls.

*Mesalia brevia*lis (Lamarek).

1757. *Cerithium mesal*, Adanson, Hist. Nat. Sénégal, p. xcv, Le Mesal, p. 159, pl. x.
 1822. *Turritella brevia*lis, Lamarek, Anim. sans vert. vol. vii. p. 58.
 1843. *Turritella brevia*lis: Kiener, Coq. Viv. p. 40, pl. xii. figs. 1, 1 a.
 1843. *Turritella mesal*, Deshayes, Anim. sans vert. ed. 2, vol. ix. p. 261.
 1847. *Mesalia mesal*: Gray, Proc. Zool. Soc. 1847, p. 155.
 1849. *Mesalia brevia*lis: Reeve, Conch. Icon. vol. v. pl. v. fig. 16 a (*Turritella*), fig. 2 b (*Mesalia*).
 1852. *Mesalia brevia*lis: Sowerby, Conch. Man. ed. 4, p. 201, pl. xxviii. fig. 591.
 1854. *Mesalia brevia*lis: H. & A. Adams, Gen. Rec. Moll. vol. i. p. 354, pl. xxxviii. fig. 4, shell (4 a, 4 b, represent the operculum of *Turritella*).
 1857. *Mesalia brevia*lis: Gray, Guide Moll. Brit. Mus. p. 111.
 1859. *Mesalia brevia*lis: Chenu, Man. Conch. vol. i. p. 317, figs. 2284, 2285.

* Amer. Journ. Conch. vol. vii. p. 119.

1878. *Mesalia brevis*: Kobelt, Illust. Conchyl. p. 138, pl. xlix. fig. 3.
 1887. *Mesalia brevis*: Tryon, Man. Conch. vol. viii. p. 209, pl. lxxv. figs. 28-29.
 1897. *Mesalia brevis*: Kobelt, Conch. Cab., *Turritella*, p. 71, pl. xxi. figs. 1-3.

Hab. Goree, Senegal, Sierra Leone.

Var. varia.

1843. *Turritella varia*, Kiener, Coq. Viv. p. 42, pl. ii. figs. 3, 3a, 3b.
 1849. *Mesalia brevis* (partim): Reeve, Conch. Icon. vol. v. fig. 2a.
 1887. *Mesalia brevis* (partim): Tryon, Man. Conch. vol. viii. pl. lxxv. fig. 27 (after Reeve), fig. 30 (after Kiener).
 1897. *Mesalia varia*: Kobelt, Conch. Cab., *Turritella*, p. 72, pl. xxi. figs. 8-11.
 1902. *Mesalia varia*, var. *imbricata*, Pallary, Journ. de Conch. vol. 1. p. 16.

Hab. Mogador, Tangier, Algeciras.

Var. freytagi.

1884. *Mesalia freytagi*, Maltzan, Nachrichtenblatt deutsch. malak. Gesell. 1884, p. 68.

Hab. Goree, Senegambia.

Whether *M. brevis* should be divided in two or more species seems somewhat doubtful, but, from the material examined, I have been unable to find a parting-line of separation between the typical very large form, which seems to be restricted to the Senegambia region, and the smaller var. *varia*, found at Mogador, Tangier, and South Spain*. The difference in size is enormous, but the sculpture, although variable in strength, is of the same character and the oral features are similar.

The typical form is well figured by Kiener (pl. xii. fig. 1), and the upper portion of his figure answers exactly to Lamarck's description "anfractibus convexis, lævibus, prope marginem superiorem unisulcatis" and "elle est fort raccourcie, relativement à sa grosseur. Longueur, 2 pouces."

Another large form is that figured by Reeve (*Turritella*, pl. v. fig. 16b). It is narrower and distinguished by finer spirals than the type. The variety *varia* is also finely ridged, but smaller; however, intermediates in size occur. *M. freytagi* has very convex whorls, most of which are bicarinate and display more colour-markings.

Turritella caribæa, d'Orbigny, said to be from Cuba, was

* Hidalgo has expressed a similar opinion (Journ. de Conch. 1867, vol. xv. p. 394).

founded on a unique worn shell, now in the British Museum. It has been considered by Tryon identical with the variety *varia*. Owing to the bad condition of the shell it is impossible to speak with certainty, but I am inclined to think he is right, in which case the West-Indian locality becomes very doubtful.

Turritella opalina, Ad. & Rve.*, said to be from the China Sea, agrees exactly with the upper portion of a typical *brevialis*. The fine spiral striation is precisely the same and the style of markings (exaggerated in the much enlarged figure) is quite similar. I am therefore inclined to believe that some mistake has occurred in regard to the locality †.

Jeffreys states that *Turritella suturalis* of Forbes ‡, from the Ægean Sea, is the same as *brevialis*, Reeve, partim (= var. *varia*), but the description given by Forbes is so inadequate that it becomes impossible to recognize the shell he had before him, which is described as only $\frac{3}{12}$ inch in length!

Mesalia flammigera, Locard.

1897. *Mesalia flammigera*, Locard, and var. *simplex*, Expéd. Sci. 'Travailleur' et 'Talisman,' Moll. test. p. 396, pl. xviii. figs. 18-22.

Hab. Deep water. "A l'ouest du Sahara" (Locard).

This may be a deep-water form of *M. brevis*, with flatter whorls than the typical form, and somewhat narrower also. As regards sculpture and coloration, there seems to be little, if any, difference. Very few of the specimens of *brevialis* (typical) I have seen show any colour-marking, but, when they so occur, they take the form of longitudinal, reddish, undulating, irregular flammulations, as described by Locard.

Mesalia pulchella, Pallary.

1901. *Mesalia pulchella*, Pallary, Journ. de Conch. vol. xlix. p. 315, vol. l. p. 16, pl. i. figs. 16, 17.

Hab. Tangier.

M. Pallary describes two varieties, var. *fusca* and var. *varicosa*, differing from the type respectively in colour and sculpture.

The animal radula and operculum are unknown, and from shell-characters this species might equally well be placed in *Turritellopsis*.

* Zool. 'Samarang,' Moll. p. 48, pl. xii. fig. 7, twice natural size of type in Brit. Mus.

† Tryon placed this species in *Mesalia*, Man. Moll. vol. viii. p. 210.

‡ Report Brit. Assoc. 1843, p. 189.

Mesalia melanioides, Reeve.

1849. *Mesalia melanioides*, Reeve, Conch. Icon. vol. v. pl. i. fig. 3.

1859. *Turritella* (*Mesalia*) *melanioides* (sic): Chenu, Man. Conch. vol. i. p. 317, fig. 2286.

1887. *Turritella* (*Mesalia*) *melanioides* (sic): Tryon, Man. Conch. vol. viii. p. 209, pl. lxxv. fig. 32 (after Reeve).

1897. *Mesalia melanioides* (sic): Kobelt, Conch. Cab., *Turritella*, p. 74, pl. xxi. fig. 5 (after Reeve).

1913. *Mesalia exilis*, Sowerby, Ann. & Mag. Nat. Hist. vol. xii. p. 236, pl. iii. fig. 9.

Hab. Unknown to Reeve. West Australia (*Sowerby*).

This species, of which only the shell is known, has an altogether different aspect from that of the type of *Mesalia*, having flatter whorls and numerous oblique costæ upon the upper part of the spire. The characters of the aperture, however, show that it is rightly placed in that genus.

In describing his *M. exilis* Mr. Sowerby observed:—"The actual position of this remarkable shell is uncertain, but I provisionally place it in *Mesalia* on account of the characteristic basal sinus." Such being his opinion, it is surprising that he did not refer to Reeve's Monograph of the genus, published sixty-four years previously, or to other works describing *Mesalia*, issued in the interval. Had he done so, he could not have failed to identify the shell he proposed describing with Reeve's *M. melanioides*. Having compared the type of that species and the actual shell described as *M. exilis*, both being in the British Museum collection, I can testify with certainty to their specific identity.

The figure in the Ann. & Mag. Nat. Hist. is not good; it shows the whorls too convex, and the basal sinus to the aperture is badly depicted.

Mesalia subdecussata (Cantraine).

1837. *Scalaria subdecussata*, Cantraine, Opusc. de Zool. et d'Anat. comp. p. 13; id. Malac. Médit. pl. vi. fig. 24 (1841).

1849. *Turritella incisa*, Reeve, Conch. Icon. vol. v. pl. xi. fig. 65.

1851. *Mesalia striata*, A. Adams, Proc. Zool. Soc. 1851, p. 279.

1855. *Mesalia plicata*, A. Ad. op. cit. 1855, p. 123.

1867. *Mesalia striata*: Hidalgo, Journ. de Conch. vol. xv. p. 394; Revista R. Acad. Cienc. Madrid, vol. i. p. 405 (1904).

1868. *Mesalia subdecussata*: Weinkauff, Conch. Mittelm. vol. ii. p. 323.

1869. *Eglisia subdecussata*: Fischer, Actes Soc. Linn. Bordeaux, vol. xxvii. p. 115.

1877. *Acirsa subdecussata*: Jeffreys, Ann. & Mag. Nat. Hist. 1877, vol. xix. p. 241.

1878. *Acirsa subdecussata*: Monterosato, Journ. de Conch. vol. xxvi. p. 151.

1884. *Scalaria subdecussata*: Jeffreys, Proc. Zool. Soc. p. 132.

1891. *Acirsa subdecussata*: Locard, Coq. Marin. France, p. 128, fig. 112.

1897. *Scalaria* (*Acirsa*) *subdecussata*: Watson, Journ. Linn. Soc. vol. xxvi. p. 315.

Hab. Atlantic coasts of France and Spain, Mediterranean, Madeira, and Canaries.

I have compared the types of *Turritella incisa*, Reeve, recorded as from Sydney, Australia, and *Mesalia striata*, A. Adams, stated to be from the Philippine Islands, with Mediterranean and Madeiran specimens, and I am convinced of their identity. I therefore regard the localities given by Reeve and Adams merely as further examples of errors of this kind which occur in the Cuming collection, from which the species were described. It is included in Mr. Whitelegge's list of the fauna of Port Jackson* merely on Reeve's authority.

According to Monterosato, the animal of this species resembles *Scalaria* in the position of the eyes and the form of the tentacles, also in the median longitudinal groove of the foot. The head has no cylindrical and retractile proboscis. He described the operculum as horny, with a spiral nucleus, placed towards the inner side of the mouth, and composed of a small number of whorls and marked with strong lines of growth. Fischer also described the operculum as paucispiral, with a lateral nucleus like that of *Scalaria* and *Littorina*. It will thus be seen that it agrees with that of the type of *Mesalia* (*M. brevis*), which is incorrectly figured as multispiral with central nucleus by H. & A. Adams (Gen. Rec. Moll. vol. iii. pl. xxxviii. figs. 4 a, b), resembling that of *Turritella*.

There are in the British Museum two specimens of *M. brevis*, from Goree, with opercula which agree closely with that of *Epitonium* (*Scalaria*) or *Littorina*. The shell-characters of the present species (*subdecussata*) differ from those of *M. brevis* in some respects. The upper whorls are longitudinally costate, the outer margin of the peristome is not sinuated above, and the basal sinus is only faintly developed. It agrees with *M. melanioides* in being longitudinally costate and the non-sinuation of the labrum, but it has not the marked basal sinus as developed in that species. Since, however, so little is known at present with regard to the animals, I think it preferable to leave this species in *Mesalia* rather than *Acirsa*, or to create a new genus for its reception.

* Journ. Proc. Roy. Soc. N.S.W. vol. xxiii. p. 262 (1889).

Mesalia intermedia (Deshayes).

1832. *Turritella intermedia*, Deshayes, Coq. foss. Environs Paris, vol. ii. p. 283, pl. xxxvii. figs. 17, 18, pl. xxxviii. figs. 3, 4.

1838. *Turritella robusta*, Sowerby, Proc. Zool. Soc. p. 211, pl. xi. fig. 18.

I have included this Paris Basin fossil in this list to call attention to the fact that the shell described as recent by Mr. Sowerby is merely a well-preserved and nicely cleaned specimen of Deshayes's species.

I perceived at a glance it was quite distinct from *Turritella*, and it occurred to me it might be an extinct form, since it was so unlike any known living species. I therefore submitted it to Mr. R. Bullen Newton, who at once identified it with this species. He kindly placed a series of specimens at my disposal for comparison and, consequently, I am in a position to confirm his determination. Mr. Sowerby's type, now in the British Museum, was, as might be expected, described without a locality.

The figure of it is very crude and inaccurate, the whorls being represented too narrow and too convex, and contracted at the lower part. The labrum being broken back somewhat gives the mouth a rounder look than in perfect specimens, and the anterior or basal sinus is less apparent.

TURRITELLOPSIS, Sars.

1878. *Turritellopsis*, Sars, Moll. Reg. Arct. Norveg. p. 186 (shell and radula figured).

1885. *Turritellopsis*, Fischer, Man. Conch. p. 694, as subgenus of *Turritella*.

1883. *Turritellopsis*, Tryon, Struct. Syst. Conch. vol. ii. p. 224, pl. lxvii. fig. 56 (shell).

1897. *Turritellopsis*, Kobelt, Conch. Cab., *Turritella*, p. 67, pl. xx. figs. 10, 11 (shell), regarded as a distinct genus.

This genus in form and sculpture is very like *Turritella*, but differs in regard to the character of the radula. The operculum is circular, multispiral, with central nucleus.

Turritellopsis acicula (Stimpson).

1851. *Turritella acicula*, Stimpson, Proc. Boston Soc. Nat. Hist. vol. iv. p. 15.

1851. *Turritella acicula*, id. Shells of New England, p. 35, pl. i. fig. 5.

1870. *Turritella acicula*: Gould, Invert. Massachusetts, ed. 2, p. 319, fig. 588.

1871. *Mesalia acicula*: Dall, Amer. Journ. Conch. vol. vii. p. 118.

1878. *Turritellopsis acicula*: Sars, Moll. Reg. Arct. Norveg. p. 186, pl. x. figs. 14, a-b; radula, pl. vii. figs. 2, a-e.

1886. *Turritella (Turritellopsis) acicula*: Tryon, Mon. Conch. vol. viii. p. 207, pl. lxiv. fig. 12.

1897. *Turritellopsis acicula*: Kobelt, Conch. Cab., *Turritella*, p. 67, pl. xx. figs. 10, 11.

Hab. Off Grand Manan, near Duck Island, and south of Cape Cod (*Stimpson*). Also recorded by other authors from Frenchman's Bay, Labrador, &c. Vadso and Magerö, north coast of Norway (*Sars*).

The animal of this species has not been described, but the operculum, according to *Sars*, is very thin, pellucid, and consists of about ten narrow and regular whorls. Dall and Tryon (*l. c. supra*) have suggested that Carpenter's "*? Mesalia tenuisculpta*"*, from California, is the same as *acicula*. This, in my opinion, is incorrect. The Californian shell is smaller, has a less tapering spire, and much finer sculpture. At a mere glance it is seen to be distinct, and recalls very closely the general form of the type of *Fenella* to which Carpenter has made reference; indeed, I think it preferable to locate it in that genus rather than in *Turritellopsis*.

Turritellopsis gratissima, Thiele.

1913. *Turritellopsis gratissima*, Thiele, Deutsch. Südpolar-Exped. vol. xiii. p. 201, pl. xii. fig. 20, pl. xv. fig. 23 (radula).

Hab. Antarctic ('*Gauss*' Expedition).

According to Thiele this species agrees practically in every essential respect with *Turritellopsis*, and although the radula exhibits small differences, it agrees with that of the boreal form (*T. acicula*) in general character.

Turritellopsis latior, Thiele.

1913. *Turritellopsis latior*, Thiele, *op. cit.* p. 202, pl. xii. fig. 21.

Hab. Antarctic ('*Gauss*' Expedition).

TACHYRHYNCHUS, Mörch.

1868. *Tachyrhynchus*, Mörch, Amer. Journ. Conch. vol. iv. p. 46.

1885. *Mesalia (Tachyrhynchus)*: Fischer, Man. Conch. p. 694.

Short descriptions of the animal of the type (*T. reticulata*) are given by Mörch & Jeffreys, and the operculum is said to be "horny, yellow, orbicular, with nine narrow turns, nearly flat." To complete this description it is only necessary

* Proc. Calif. Acad. Nat. Sci. 1866, p. 216.

to add that the nucleus is central, and, in character, the operculum is similar to that of *Turritella*, which is also multispiral, and not paucispiral, like that of *Mesalia*. The genus will include *Turritella reticulata*, Mighels & Adams, *T. erosa*, Couthouy, *T. eschrichtii*, Middendorff, *Mesalia lacteola*, Carpenter.

All of these species have an arctic appearance, being chalky white, and clothed with a thin yellowish-olivaceous periostracum, differing in this respect from *Turritella*, which exhibits scarcely any traces of it, or might even be described as devoid of it.

The radulæ of *T. reticulata* and *T. erosa* are of the same character as that of *Turritella*, and the differences noticeable are probably merely specific.

The base of the aperture in *Tachyrhynchus* exhibits more or less of a sinus, it being most distinctly shown in *T. lacteola*, Cpr. In *Turritella* there is no such emargination or effusion.

Tachyrhynchus is at once separable from *Mesalia* by the different operculum, and its boreal character. Like *Turritella*, *Mesalia* exhibits usually only very faint indications of the periostracum.

Tachyrhynchus erosa (Couthouy).

1838. *Turritella erosa*, Couthouy, Boston Journ. Nat. Hist. vol. ii. p. 103, pl. iii. fig. 1.
 1841. *Turritella erosa*: Gould, Invert. Massachusetts, p. 267.
 1842. *Turritella polaris* (Beck MSS.), Möller, Index Moll. Grœnland. p. 10.
 1849. *Turritella erosa*: Middendorff, Malac. Ross. p. 68.
 1852. *Turritella erosa*: Mörch, Cat. Conch. Yoldi, p. 54.
 1857. *Turritella erosa*: Mörch, Rink's Grœnland, vol. ii., Naturhist. Bidrag, p. 82.
 1868. *Tachyrhynchus erosa*: Mörch, Amer. Journ. Conch. vol. iv. p. 46, animal.
 1870. *Turritella erosa*: Gould, Invert. Massachusetts, ed. 2, p. 317, fig. 585.
 1871. *Mesalia polaris*: Dall, Amer. Journ. Conch. vol. vii. p. 118.
 1877. *Turritella erosa*: Jeffreys, Ann. & Mag. Nat. Hist. vol. xix. p. 239.
 1885. *Turritella erosa*: Aurivillius, Vega-Exped. vol. iv. p. 322, pl. xii. fig. 7, pl. xiii. fig. 17 (radula).
 1886. *Turritella* (*Turritellopsis*) *erosa*: Tryon, Man. Conch. vol. viii. p. 208.

Hab. Massachusetts (*Couthouy* & *Gould*); Maine (*Blaney*); Labrador (*Bush*); Greenland (*Möller*); Davis Straits ('*Valorous*' *Exped.*); Nova Scotia (*Brit. Mus.*).

The operculum of this species is described by Mörch as similar to that of *reticulata*, and a specimen in the British Museum confirms his description: "Horny, yellow, orbicular,

with nine narrow turns, nearly flat." It is also characterised by Gould as "horny, multispiral."

Jeffrey (*l. c. supra*) has described the living animal and also made some observations upon the composition of the shell and its liability to corrosion. He described the operculum as "round and multispiral, with the nucleus in the centre; the edges of the whorls overlap, as in *T. terebra*."

I cannot, judging from Middendorff's description of *T. eschrichtii*, agree with Tryon (*l. c. supra*) that it is synonymous with the present species.

Tachyrhynchus eschrichtii (Middendorff).

1849. *Turritella eschrichtii*, Middendorff, Malac. Ross. p. 68, pl. xi. fig. 1.

1886. *Turritella* (*Turritelopsis*) *erosa* (partim), Tryon, Man. Conch. vol. viii. p. 208, pl. lxiv. fig. 14 (after Middendorff).

Hab. Sitka, Alaska (*Middendorff*).

This species is closely allied to *erosa*, but the whorls are said to be flatter, and apparently higher, since, if viewed dorsally, the last whorl, it is stated, equals almost one-third of the whole length of the shell, whereas in *erosa* it equals only one-fourth. The base of the body-whorl in the latter is almost flat and circumscribed by a distinct angle. In *eschrichtii*, on the contrary, the periphery and base are rounded. The aperture is longer and oval, whilst in *erosa* it is shorter and rounder. Animal and operculum unknown.

Tachyrhynchus reticulata (Mighels & Adams).

1842 (January). *Turritella reticulata*, Mighels & Adams, Boston Journ. Nat. Hist. vol. iv. p. 50, pl. iv. fig. 19.

1842. *Turritella lactea*, Möller, Index Moll. Grönland. p. 9.

1849. *Mesalia lactea*: Reeve, Conch. Icon. vol. v. pl. i. fig. 1 (enlarged).

1857. *Turritella reticulata*: Mörch, Rink's Grönland, vol. ii., Naturhist. Bidrag, p. 82.

1861. *Turritella lactea*: Troschel, Gebiss der Schnecken, vol. i. p. 153, pl. xii. figs. 13-13 b.

1868. *Tachyrhynchus reticulata*: Mörch, Amer. Journ. Conch. vol. iv. p. 46, animal.

1870. *Turritella reticulata*: Gould, Invert. Massachusetts, ed. 2, p. 318, fig. 586.

1871. *Mesalia reticulata*: Dall, Amer. Journ. Conch. vol. vii. p. 118.

1877. *Turritella reticulata*: Jeffreys, Ann. & Mag. Nat. Hist. vol. xix. p. 240.

1886. *Turritella* (*Turritelopsis*) *reticulata*: Tryon, Man. Conch. vol. viii. p. 208, pl. lxv. fig. 25, after Reeve.

1897. *Turritelopsis reticulata*: Kobelt, Conch. Cab., *Turritella*, p. 69, pl. xx. figs. 16, 17.

Hab. Gulf of St. Lawrence (*M. & Ad.*); Labrador and E. Canada (*Bush & Whiteaves*); Greenland (*Möller*).

In the words of the original describers of this species, it "is allied to *T. erosa*, Couth., but is easily recognized by the longitudinal ribs and by its more slender form" (*Mighels & Adams*).

The two forms are considered by Aurivillius to constitute one species, and he describes and figures a very different shell under the varietal name *declivis* *. Judging from the figure, however, it certainly looks quite distinct. The whorls are remarkably convex, without spiral or longitudinal costæ, and much higher in proportion to their width, and, in addition, the peristome is entire. Without examining a specimen I must refrain from suggesting the generic position of this shell.

Tachyrhynchus lacteola (Carpenter).

1864. *Mesalia lacteola*, Carpenter, Report Brit. Assoc. 1863, pp. 603, 655, name only.

1865. *Mesalia lacteola*, id. Proc. Acad. Nat. Sci. Philad. p. 62.

Hab. Puget Sound and Vancouver Isl. (*Cpr.*).

This species has been considered by Tryon synonymous with *T. reticulata*, but in my opinion it is quite distinct. Besides being smaller and shorter, the sculpture is more nodulous and the form of the aperture is different being

Fig. 3.



produced and effuse at the base. The character of the operculum, however, at once distinguishes the species. It is horny, roundly ovate, but pointed above, slightly concave, consists of only 4-5 whorls, which increase rather rapidly, are carinate at the sutures, and marked with conspicuous lines of growth, and the nucleus is a little excentric. As already pointed out, that of *T. reticulata* is circular, multi-spiral, consisting of nine whorls.

* Vega-Exped. Vetensk. Jakttag. vol. iv. p. 324, pl. xii. fig. 9 (1887).

Tachyrhynchus subplanata (Carpenter).

1865. *Mesalia* (? *lacteola*, var.) *subplanata*, Carpenter, Proc. Acad. Nat. Sci. Philad. p. 62.

Hab. Puget Sound, Washington Territory, West N. America; also Neenah Bay (*Cpr.*).

I have not seen this shell, and therefore cannot express any opinion upon its specific value. The author of the species appears to have been doubtful upon this point.

Tachyrhynchus ? *costulata*, Mighels & Adams.

1842. *Turritella costulata*, Mighels & Adams, Boston Journ. Nat. Hist. vol. iv. p. 50, pl. iv. fig. 20.

1870. *Turritella costulata*: Gould. Invert. Massachusetts, ed. 2, p. 318, fig. 587, apparently after M. & Ad.

Hab. Casco Bay, Maine, U.S.A. Taken from the stomach of a haddock (*M. & Ad.*).

This species, united by Tryon with *T. reticulata*, is evidently distinct. The fine longitudinal costæ and microscopic spiral striæ at once distinguish it from that form. Apparently a rare shell, and known to me only by the description and figure.

A pseudo-Mesalia.

Mesalia decussata, A. Adams, Proc. Zool. Soc. 1851, p. 279.

Hab. Island of Masbate, Philippines.

The type of this species is in the British Museum, and a careful examination of it proves that it belongs to the genus *Mormula* in the Pyramidellidæ.

The form of the aperture, the character of the sculpture, and the thickening of the labrum (the previous labra forming varices at irregular intervals up the spire) are all features characteristic of *Mormula*.

Mr. J. R. Le B. Tomlin has shown me several specimens in his collection from Japan and Lifu, which confirm the distinctness of this species from *Mormula rissoina* of A. Adams*, also from Japan, to which it bears some resemblance.

I might here point out that *Rissoina rex*, of Pilsbry†, is identical with *Mormula rissoina*. Evidently his specimens had not retained their heterostrophe protoconch, and consequently he was misled as regards their true generic location.

* Journ. Linn. Soc. 1863, vol. vii. p. 1; Smith, Ann. Natal Gov. Mus. vol. i. p. 51, pl. viii. fig. 2.

† Proc. Acad. Nat. Sci. Philad. 1904, vol. lv. p. 27, pl. iv. figs. 42, 42 a.

XXXIII.—*A Parasitic Oligochæte, and other Inhabitants of the Gill-chambers of Land-crabs.* By H. A. BAYLIS, B.A.

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A SMALL Oligochæte worm of the family Enchytræidæ occurs frequently in considerable numbers in the gill-chambers of the crab *Gecarcinus lagostoma* in the island of South Trinidad. Having been engaged in the study of this species, for which I have proposed the name *Enchytræus carcino-philus* [2], it occurred to me that it might be of interest to examine the gill-chambers of other crabs of the family Gecarcinidæ, with a view to finding out whether they harboured any further Oligochætes or other parasites.

Through the kindness of Dr. W. T. Calman, I was able to examine specimens in the British Museum bearing the following names:—

- Cardisoma guanhumi.*
- *hirtipes.*
- *armatum.*
- *carnifex.*
- sp.? (Lagos, W. Africa).
- Ucides cordatus.*
- *occidentalis.*
- Gecarcinus lateralis.*
- *ruricola.*
- *quadratus.*
- Gecarcoidea lalandii.*

The results of this investigation were as follows:—

Organisms which may possibly be regarded as parasites were found in only three of the eleven species above named, viz.:—*Cardisoma hirtipes*, *Gecarcinus quadratus*, and *Gecarcoidea lalandii*. In *Gecarcinus quadratus* were found very numerous examples of a small Enchytræid worm, which proves to be specifically distinct from that already recorded as occurring in *G. lagostoma*, and which will be described below.

In *Cardisoma hirtipes* and *Gecarcoidea lalandii* the creatures found proved to be dipterous larvæ of two distinct species, though it was found impossible to determine them precisely.

The facts, with localities, may be shortly stated thus:—

Gecarcinus quadratus: from Clarion Island (Pacific).

One specimen only examined. Very many small *Oligochæta* found on and among the gills.

Cardisoma hirtipes: (a) from the Admiralty Islands ('Challenger' Collection).

Two out of three specimens examined had dipterous larvæ in their gill-chambers.

(b) from Christmas Island.

One out of three specimens had a fragment of a larva adhering to the outside of it, near the lateral opening of the gill-chamber.

Gecarcoidea lalandii: from Christmas Island.

Out of three specimens one provided three very small larvæ.

Mr. F. W. Edwards, of the Entomological Department of the British Museum, who has examined the dipterous larvæ, kindly supplies me with the following information:—

"Dipterous larvæ from *Cardisoma hirtipes*.—These larvæ are evidently Syrphidæ, and apparently belong to the subfamily *Eristalinæ*; they differ from *Eristalis* in the more elongated form and the lack of any obvious separation into 'body' and 'tail.'

"Larvæ from *Gecarcoidea lalandii*.—These are also Syrphidæ, but in the present state of our knowledge it is impossible to assign them definitely to any subfamily. They appear to lack the extensile 'tail' of *Eristalis*."

Whether these larvæ ought properly to be considered parasites of the crabs is, perhaps, a matter of doubt*. It is, of course, possible that they arrived in their gill-chambers accidentally. They may have wandered there from some decaying matter upon which the crabs were feeding, according to their habit, or from the water of some stream entered by the crabs. According to Dr. C. W. Andrews [1], *Cardisoma hirtipes* (referred to under the name of *C. carnifex*) is never found far from the streams in Christmas Island, and lives in burrows in the mud of the banks, and it would be rash to

* It should be borne in mind that there is a remote possibility that the eggs were deposited upon the crabs after death, in which case the larvæ could not be called parasites.

assert that *Gecarcoidea lalandii*, though apparently a more land-loving species, never enters fresh water.

In any case, however, whether the eggs were deliberately deposited in or near the gill-chambers by the female fly, or whether the larvæ subsequently wandered into them, either accidentally or following some regular instinct, they would appear to have thriven there, and it is suggested as at least a possibility that they derived sustenance from the blood of the crabs, their chitinous "jaws" enabling them to puncture the epithelium of the gills or of the vascular lining of the chamber.

With regard to the Oligochæte worms, the case is even more puzzling, as they have not even jaws, and it is difficult to see what food, except, perhaps, mucus, they can obtain in such a habitat. The remarks made on this head concerning *Enchytræus carcinophilus* [2, p. 14] apply equally to the present species, which I now proceed to describe.

Enchytræus parasiticus, sp. n.

This form is evidently very closely related to the species (*E. carcinophilus*) described by me from the gill-chambers of *Gecarcinus lagostoma* [2]. It differs from it, however, in certain features sufficiently to constitute a distinct species. In size it is considerably smaller than *E. carcinophilus*, measuring only 8-9 mm. in length, or about one-quarter of the length of a full-grown specimen of the larger species. Its thickness is about 0.35 mm. The number of segments in several specimens in which they were counted was found to vary between 69 and 82.

The chætæ are arranged, as usual, in 4 bundles to each segment, but there are invariably only 2 chætæ in each bundle; they are simple, pointed, and straight. Segments i. and xii., as in the other species, are without bristles.

There is a very marked ventral flexure of the anterior end of the worm, the prostomium being bent down into a vertical position, and the mouth being therefore quite ventral. This peculiarity was not observed in *E. carcinophilus*, but in the present species is so constant a feature that the specimens invariably lie on their sides, and can only with considerable difficulty be mounted in any other position.

The clitellum is very feebly developed as compared with the larger species. It is, in fact, very inconspicuous, but can be made out as a very slight thickening, containing glandular cells, extending from about the middle of seg-

ment xii. to the middle of xiii. in those specimens in which it is most developed.

The openings of the male ducts are situated near the hinder end of segment xii., on somewhat prominent "cushions." Their lips, however, are by no means so large and prominent as in *E. carcinophilus*.

The apertures of the spermathecae lie, as usual, at the point of junction of segments iv. and v.

INTERNAL ANATOMY.

Owing to the poor state of preservation of the material (with which, of course, no trouble had been taken, as the presence of the worms in the crab's gill-chambers was presumably unknown) it was not found possible to obtain good sections, and the account of the internal anatomy is necessarily incomplete.

Alimentary Canal.—The mouth, as already stated, is situated ventrally. The buccal cavity leads, therefore, almost perpendicularly at first. It is very narrow dorso-ventrally (*i. e.* from front to back). The floor of it does not appear to be furnished with a tongue-like organ such as that seen in *E. carcinophilus*. The pharynx has a large muscular pad in its roof, of a somewhat different shape from that of the other species. This has not been observed in an everted condition. No salivary glands have been seen.

The septal glands are in three pairs, situated, as in the other species, in segments iv., v., and vi. But the first and second pairs form continuous masses passing completely over the dorsal side of the œsophagus, which at this point is very narrow. The third pair are smaller, and do not join dorsally in this manner.

It has not been found possible to give an account of the blood-vascular or nephridial organs.

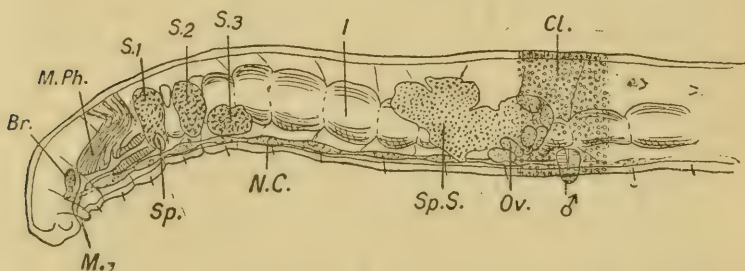
The brain is of a shape very similar to that of *E. carcinophilus*, the posterior border being nearly a straight line, with a just perceptible concavity. The nerve-cord presents no feature worthy of notice.

Genital Organs.—The large sperm-sacs occupy segments x. and xi., and have an extension anteriorly into segment ix. The structure of the sperm-funnels has not been made out, but the ducts, as in the other species, are very long and much coiled, and lead to the base of the muscular prominences on which the external spermiducal pores are situated.

The ovaries are situated in segment xii., on the septum

xi./xii. The ova, when liberated, are provided with a large supply of yolk. The oviducts have not been made out with certainty, but it is probable that they are, as usual, simply outpushings of the septum xii./xiii. to meet the body-wall.

The spermathecæ open on either side at the septum iv./v., and run backwards for a short distance as narrow tubes. Between the first and second septal glands each expands into a larger chamber with folded walls, and from this a duct runs inwards at right angles to open into the œsophagus. The openings are lined with long cilia projecting into the lumen of the gut. The narrower distal portions of the spermathecal ducts are covered externally with five longitudinal rows of gland-cells.



Lateral view of the anterior end of *Enchytræus parasiticus*. Some of the internal organs are represented as seen by transparency.

Br., brain; Cl., clitellum; I., intestine; M., mouth; M.Ph., muscular pad of pharynx; N.C., nerve-cord; Ov., ova; S.₁, S.₂, S.₃, the three pairs of septal glands; Sp., aperture of spermatheca; Sp.S., spermisac; ♂, spermiducal pore.

Enchytræus parasiticus, sp. n.

DIAGNOSIS:—Length 8–9 mm. Number of segments about 70–80. Chatæ 2 per bundle. Brain nearly straight behind. Spermathecæ narrow distally, with 5 rows of gland-cells externally; expanding into a pouch with folded walls before opening by a wide ciliated aperture into the œsophagus.

Hab. Interior of the gill-chambers of a land-crab, *Gecarcinus quadratus*, Saussure [= *G. ruricola*, L.*]. Clarion Island (Pacific Ocean).

* Concerning the nomenclature of the host, Dr. W. T. Calman kindly submits the following note:—

“The specimens from Clarion Island are labelled *Gecarcinus quadratus*, Saussure, and I do not venture to dispute the identification, although I am unable to form any clear conception of the distinguishing characters

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XXXIV.—*The Penis-bone, or "Baculum," as a Guide to the Classification of certain Squirrels.* By OLDFIELD THOMAS.

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THERE has always appeared to be something wrong with the inclusion of the Oriental squirrels in the same genus as *Sciurus vulgaris*, although when classifying the group some years ago I was unable to find any material differences in their skulls and teeth.

Now, however, I have found a character by which such squirrels as are still put in *Sciurus* may be sorted into several groups, each sharply defined from the others.

This is in the structure of the *os penis*, which shows very striking differences between the various groups of species, and may evidently be of great service in classifying the members of this difficult family. For many years I have

of this species. The specimens differ in the form of the carapace and third maxillipeds from *G. malpensis* as described by Faxon (Mem. Mus. Comp. Zool. xviii. 1895, p. 28); in the proportions of the carapace and legs from *G. digueti*, Bouvier, as redescribed by Rathbun (U.S. Dep. Agric. N. Amer. Fauna, no. 14, 1899, p. 73); and in having six spinerows on the dactyli, from *G. lateralis* (Fremenville). I am not aware that anyone has attempted a detailed criticism of Ortmann's opinion (Zool. Jahrb. Abth. f. Syst. x. 1897, p. 337) that all the American forms belonging to this genus can be referred to a single species, *G. ruficollis* (Linn.)."

been collecting materials for the study of this bone, and hope later to be able to give a general paper upon it, but, as a preliminary, it seems advisable to publish a note on certain cases affecting nomenclature and generic position.

Since every other bone of the skeleton has a name of its own, not merely the "bone of the leg" or "bone of the head," it appears to me convenient to have a special term for the bone of the penis, and I therefore propose to call it the *baculum*, meaning a little stick.

Now the *baculum* of *Sciurus vulgaris*, the type of the genus, is a very characteristic bone, like a small spatula, or still more like a half-closed human right hand, the shaft forming the forearm, the blade of the spatula the hollowed palm, and a small pointed projection on the right side corresponding to an outstretched thumb.

Of this type, and agreeing with it exceedingly closely, are the *bacula* of the other Palaearctic species, *S. persicus* and *S. lis*, of the whole of the American species, so far as I have been able to examine them, and, remarkable to say, of the Bornean *Reithrosciurus macrotis*.

But all the Indian and Malayan species hitherto referred to *Sciurus* have *bacula* totally different from that of true *Sciurus*, and themselves divisible into two types, though with an essential community between the two.

For in all the *baculum* consists of two parts, a shaft or *capulus* of varying length and a separate sharp blade or *lamina* attached to the shaft by ligament and slightly movable upon it. The *lamina* has a concave base, which articulates with the rounded surface of the shaft, and allows a certain amount of lateral play.

In position in the penis the blade points to the right, its edge cutwards. This edge is very sharp indeed, is practically uncovered by tissue of any sort, and seems to be for the purpose of enlarging the female opening by a clean knife-cut into the tissues. A careful study of the soft anatomy of the female will be needed before the exact objects and methods of this remarkable structure can be understood. It is possible that the little, sharp, thumb-like projection on the *baculum* of typical *Sciurus* has a somewhat similar function.

As already noted, the compound *bacula* are of two types, respectively more and less specialized.

The less specialized consists of a long, slender, slightly curved shaft, with a narrow blade set on the side of it, in the concavity of its general curvature. The blade is attached nearly throughout its length, and its greatest breadth is only

about one-fourth to one-sixth of its length, so that it projects from the shaft as quite a low cutting-blade.

In the more specialized type the lamina is attached to the side of the end of the shaft, and is developed into a long triangular and pointed blade, recurved backwards towards the hilt of the shaft, which it may equal or exceed in length.

A considerable number of species which have been referred to "*Sciurus*" have bacula of the less specialized compound type, while *Lariscus*, *Tamias*, *Dremomys*, *Nannosciurus*, and a further number of "*Sciurus*" have the more specialized type last described.

But since the possession of such striking and sharply definable characters must indicate blood-relationship, it is evident that forms with all three types of bacula should not be put into the same genus, *Sciurus*, and I would therefore withdraw from that genus all those with compound bacula, and divide these again into two genera corresponding to the less and the more specialized forms above described.

Of the first of these, that with the narrow-bladed baculum, the name would appear to be *Callosciurus*, Gray *, with type "*Sciurus*" *rafflesii*. Other synonymic names are *Baginia*, Gray † (type *S. notatus*), *Erythrosciurus*, Gray ‡ (*ferrugineus*), and *Heterosciurus*, Trouessart § (*ferrugineus*).

The species that I know to be referable to *Callosciurus* are as follows, the names put in the first column being those of which the character of the baculum has been definitely verified, while the names in brackets indicate a number of prominent species presumed to belong to the genus from their near alliance to the verified species :—

<i>Callosciurus atrodorsalis</i>	(<i>rubeculus</i> .)
„ <i>caniceps</i>	(<i>concolor, griseimanus, epomophorus</i> .)
„ <i>castaneiventris</i> . .	(<i>gordoni, styani</i> .)
„ <i>erythræus</i>	(<i>ferrugineus, finlaysoni</i> .)
„ <i>notatus</i>	(<i>vittatus, nigrovittatus, saturatus</i> .)
„ <i>pluto</i>	(<i>atricapillus, caroli, bahuensis, erythromelas, prevostii, rafflesii, rufoniger</i> .)
„ <i>sladeni</i>	(<i>haringtoni</i> .)

Curiously enough, though there are four names available for the first genus, there are none for the second, that with a long recurved blade on the baculum, and I would therefore propose to give it the name of *Tomeutes* ||.

* Ann. & Mag. Nat. Hist. (3) xx. p. 277 (1867).

† T. c. p. 279.

‡ T. c. p. 285.

§ Le Nat. ii. no. 37, p. 292 (1880).

|| Based on *τομεύς*, a shoemaker's knife.

For type I would select *Tomeutes lokroides* (*Sciurus lokroides*, Hodgs.), and, so far as can now be ascertained, the list of the chief species would be as follows, arranged, as before, into verified species, in the first column, and consequential species in brackets :—

Tomeutes lokroides.

„	<i>similis.</i>	
„	<i>phayrei.</i>	
„	<i>blanfordi.</i>	
„	<i>pygerythrus.</i>	
„	<i>janetta.</i>	
„	<i>pryeri</i>	(<i>hippurus</i> group.)
„	<i>philippinensis</i>	(<i>steerei</i> , <i>juvencus</i> .)
„	<i>melanogaster</i>	(<i>atratus</i> .)
„	<i>tenuis</i>	(<i>pumilus</i> , <i>fraterculus</i> , and many others.)
„	<i>brookei.</i>	
„	<i>lowii.</i>	
„	<i>murinus.</i>	

It is to be hoped that by degrees the bacular characters of the remaining Oriental squirrels may be ascertained, for their skulls and teeth often give little clue to their proper situation. Unfortunately in preparing dry specimens the skin of the penis readily slips off, and the baculum is thrown away with the carcase, unless the collector has been specially told to save it. The majority of the bacula I have been able to secure, apart from a number carefully preserved by Mr. Shortridge, have been extracted from spirit-specimens.

I may note that Mr. Shortridge tells me that, so far as he has seen, the species I have put into *Tomeutes* are, on the whole, more terrestrial in their habits than those of *Callosciurus*, although there are a few exceptions.

In the preliminary study of this subject that I have so far been able to make, a few points stand out very clearly.

Firstly, the wide, or at least absolutely complete, separation of the forms with compound bacula as compared with all the other Sciuridæ, and their comparatively near relationship to each other. Consequently the separation of the Nannosciurinae as a subfamily set over against other squirrels is flatly contradicted by the *Tomeutes*-like bacula of the type-genus, with but little special peculiarity. (The edge of the blade in *N. whiteheadi* is beautifully serrated, but this is not the case in certain other species.)

The presence of a simple baculum in *Myosciurus minutus*, which is therefore after all not related to the Malayan *Nannosciurus*, and is further evidence of the invalidity of the "Nannosciurinae" as a subfamily.

Then the extreme uniformity of the bone in *Sciurus vulgaris*, the American *Sciuri*, and *Reithrosciurus*.

The absence of compound-baculum forms from Africa, and their dominance in the Oriental region, where, apart from *Reithrosciurus*, only *Ratufa* and *Funambulus* have simple ones.

The resemblance of the baculum of *Ratufa* to that of the African *Protoxerus*, and the possibility that there is some special relationship between the giant squirrels of Asia and West Africa.

The development of the compound bacula along two lines, to one or other of which nearly all forms may be readily assigned. Thus the bacula of *Tamias*, *Dremomys*, *Lariscus*, and *Nannosciurus* are all absolutely of the *Tomeutes* type, while the many species of *Callosciurus* belong to the other. *Menetes* alone is rather more doubtful, its peculiarly slender-shafted baculum having a blade somewhat connecting the two types.

Observations on the forms found in allied groups, in *Tamias*, *Citellus*, the flying squirrels, and others must be reserved for a future paper.

XXXV.—On some Pteropine Bats from Vulcan and Dampier Islands, off the N.E. Coast of New Guinea. By OLDFIELD THOMAS.

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THE British Museum has received a small collection of mammals obtained by Mr. A. S. Meek on the two islands mentioned in the title, and among them are examples of three members of the genus *Pteropus*. One of these, from Dampier Island, may be referred to *P. hypomelanus luteus*, but its representative in Vulcan Island appears to be a new race of that widely distributed species. With *P. h. luteus*, on Dampier Island, there also occurs a new form of the *P. mariannus* group.

Pteropus basiliscus, sp. n.

General characters as in *P. tonganus* and *vanicorensis*, the species being similarly a large-eyed member of the *P. mariannus* group. Colour of head above pale greyish brown, passing gradually into the ochraceous buffy of the mantle. Back

seal-brown mixed with greyish-white hairs. Chin and interramia blackish brown; sides of neck dull ochraceous buffy; abdomen blackish brown, liberally mixed with shining whitish hairs.

Skull and teeth as in *P. tonganus*.

Dimensions of the type:—

Forearm 142 mm. (other specimens 141 and 136).

Third finger, metacarpus 94 (other specimens 98 and 92); first phalanx 67, second phalanx 101.

Skull: greatest length 65.6; maxillary tooth-row 24.7; diameter of orbit 13.3.

Hab. Dampier (=Krakar Island), off the N.E. coast of New Guinea, from which the island is separated by Basilisk Strait.

Type. Adult female. B.M. no. 15. 2. 18. 2. Collected 20th February, 1914, by A. S. Meek. Presented by Oldfield Thomas. Three specimens.

Although I provisionally use a binomial name for this bat, to fall in with Dr. Andersen's arrangement of the group, I am inclined to think that, in company with *P. vanicorensis*, it will later be considered as a local subspecies of *P. tonganus*. From the former, which I have not seen, it would appear to be distinguishable by the paler-coloured head, not sharply contrasted with the colour of the mantle, while from the latter it may be separated by its more ochraceous mantle and its browner back and belly. Its geographical position is a long way off from the Santa Cruz and Tonga groups of islands, the respective localities of the other two forms.

Pteropus hypomelanus vulcanius, subsp. n.

Top of head dull buffy, with an intermixture of shining buffy hairs, this colour passing into the darker buffy or ochraceous buffy of the nape. Back abruptly brown, lined and rendered more greyish by an intermixture of light buffy or whitish hairs. Cheeks darker than crown. Interramia smoky brown. Throat dull buffy, browner in the middle line; sides of neck deep buffy like nape. Chest and belly dark olive-brown, washed with buffy or dull whitish.

Dimensions of the type:—

Forearm (c.) 130 mm.

Third finger, metacarpus 90; first phalanx 64, second phalanx 99.

Skull: greatest length 66.

Hab. Vulcan (=Manumudar) Island, N.E. New Guinea.

Type. Adult male. B.M. no. 15. 2. 18. 4. Collected 29th

December, 1913, by A. S. Meek. Presented by Oldfield Thomas. Six specimens examined.

This sub-species is evidently most nearly allied to *P. hypomelanus luteus*, K. And., which Mr. Meek obtained on Dampier Island, but is readily distinguishable by its much darker chest and belly, which contrast strongly with the colour of the neck, instead of nearly agreeing with it. *P. h. luteus* was recorded by Dr. Andersen from S.E. New Guinea, extending up to the Huon Gulf. Its occurrence in Dampier Island is therefore not surprising.

To some extent this subspecies of *hypomelanus* tends to take on the characteristic colour-pattern of *P. mariannus* and its allies, and confirms Dr. Andersen's remarks on the affinities of the two groups ('Catalogue,' p. 172).

XXXVI.—On some Australian Malacodermidæ and Curculionidæ collected by Mr. G. E. Bryant. By ARTHUR M. LEA.

IN 1908 Mr. Bryant spent some months collecting insects in Australia. Of the beetles taken, the majority of the Malacodermidæ and Curculionidæ* were sent to me for examination, and the number of new species obtained will show the care taken with many of the smaller forms, so often passed over by collectors.

Mr. Bryant writes that in the year named he "arrived at Fremantle on 21st July, spent two weeks collecting round Fremantle, Perth, and Mundaring. Too early in the season to do much good. Arrived at Adelaide 8th August, and spent a week there, and then two weeks in Victoria. Arrived at Sydney the end of August, and spent five months collecting in New South Wales. Baan Baa is in the north of New South Wales, between Walgett and Werris Creek. Spent about a week round Brisbane and a month at Cairns and Kuranda, and finally left Australia from Port Darwin."

In addition to the localities of specimens taken by Mr. Bryant, I have given others when specimens of the same were in my own or in other collections. A few of the species here described were not actually taken by Mr. Bryant,

* The Belides, about fifteen species, were overlooked when the specimens were sent to me, and the Amycterides were examined by Dr. Ferguson.

but they were included as being very close to some that were taken by him.

Malacodermidæ.

Telephorus gracilipictus, sp. n.

♂. Head (except part of front, mouth-parts, and middle of under surface), middle of metasternum, knees, and apex of abdomen black; six apical joints of antennæ and upper surface of the others, most of hind tibiæ and parts of the others, and parts of all the tarsi more or less deeply infuscated; elytra of a rather dark metallic green; elsewhere more or less reddish flavous. With very short pale pubescence.

Head about as long as the width across eyes, three impressions between eyes, the median one subtriangular and fairly distinct, the others shallow, two smaller ones behind them. Antennæ thin, passing middle of elytra, fourth joint slightly longer than fifth and distinctly longer than second and third combined. *Prothorax* slightly longer than wide; median line short and distinct, sides irregularly impressed longitudinally, base rather widely and shallowly depressed. *Elytra* rather narrow, diminishing in width from about basal fourth; densely and coarsely punctate, punctures smaller across base than elsewhere.

Length $6\frac{1}{2}$ – $7\frac{1}{2}$ mm.

Hab. Queensland: Kuranda.

In some respects close to *nobilitatus* and *viridipennis* (in my table in Trans. Ent. Soc. London, 1908, p. 114, it would be associated with the latter), but the prettily variegated legs are at once distinctive. In appearance it is close to *Selenurus granulatus*, but the prothorax is of different shape and of one colour, and most of the head is black.

The surface of the elytra, except about the base, might be regarded as granulate-punctate. From some directions vague traces of an elevated line are visible on each. The abdomen is greatly shrivelled in the (two) specimens before me, but the subapical segment is certainly deeply incised.

Telephorus froggatti, Macl.

Mr. Bryant has taken at Kuranda three specimens that I cannot structurally distinguish from *froggatti*. They differ, however, in having the head entirely pale and the elytra entirely smoky brown; but, as there are several intermediate forms in my own collection, they probably represent a variety only.

Telephorus mossmani, Macl. Kuranda.

T. rubriceps, Macl. Kuranda.

T. nobilitatus, Er. Blue Mountains, Sydney, National Park.

Selenurus sydneyanus, Blackb. Sydney.

S. annulatus, Macl. Kuranda.

S. tricolor, Lea. Blue Mountains.

Heteromastix bryanti, sp. n.

♂. Flavour; elytra, metasternum, and abdomen black, tarsi and antennæ (base and apex excepted) more or less infuscated. Elytra and under surface with very short pubescence.

Head wide and shining. Antennæ long and rather stout, two apical joints distorted and as long as the eight preceding combined. *Prothorax* about twice as wide as long, margins elevated and feebly dilated anteriorly. *Elytra* feebly dilated to beyond the middle; with dense and irregular but not coarse punctures. Penultimate segment of *abdomen* deeply incised. *Legs* rather long and thin.

Length $3\frac{1}{2}$ mm.

♀. Differs in having the antennæ shorter, with the tenth and eleventh joints dark and simple; the eleventh is almost as long as the ninth and tenth combined, cylindrical, with the apex conical; abdomen with the penultimate segment not incised, and the four hind femora and parts of all the tibiæ infuscated.

Hab. Queensland: Kuranda.

In my table (Trans. Ent. Soc. London, 1908, p. 131) would be associated with *mirabilis*, from which it differs in being smaller, with a greater portion of the legs and of the antennæ pale, and in the shape of the two terminal joints of the latter. The two apical joints of the antennæ are, perhaps, more remarkable than those of any other species of the genus. They are so closely applied together that it is somewhat difficult to describe their apparent shapes; the tenth appears to be hollow, with a basal projection from the eleventh extending almost its entire length within the hollow; thus the eleventh from one direction appears to be twice as long as the tenth, but from another direction it actually appears to be shorter than the tenth; near its apex it is constricted all round, so that the tip appears to be knobbed.

Heteromastix flavoterminalis, sp. n.

♂. Black; muzzle, prothorax, scutellum, mesosternum, four front femora and tibiae, and apical and three basal joints of antennæ flavous, hind knees and trochanters obscurely diluted with red. With very short pubescence on most of surface.

Head wide and shining. Antennæ moderately long and rather stout, two apical joints distorted. *Prothorax*, *elytra*, *abdomen*, and *legs* much as in preceding species.

Length $3\frac{3}{4}$ mm.

Hab. Queensland: Kuranda.

In my table would be associated with *bicolor*, from which it differs in being slightly larger and wider, much more of legs and antennæ dark, and the latter stouter, with the two apical joints of very different shapes. The eleventh from most directions is apparently twice as long as the tenth, constricted near apex, and on one side near base, on this side fitted into tenth, so that only narrow portions of the sides and base of the latter are visible; from another direction it appears to have an acute basal projection fitted into a deep notch on the tenth; from still another direction the tenth seems to have a distinct extension overlapping the base of the eleventh. The ninth is slightly smaller than the eighth, and rather acute at one side of its apex.

The strong general resemblance between many species of this genus is remarkable; colours and shapes of all parts, except of the antennæ of the male, are often almost or quite identical, and yet the terminal joints of the antennæ differ to an astonishing extent.

Heteromastix crassicornis, Lea. Kuranda.

H. gagaticeps, Lea. Baan Baa, Sydney, Ourimbah.

H. amabilis, Lea. Blue Mountains.

H. victoriensis, Blackb. National Park.

H. bicolor, Boh. Ourimbah.

Hypattalus apicipennis, sp. n.

♂. Head and under surface black; legs blackish, in places diluted with red; antennæ black, three basal joints partly reddish; elytra purple, bluish at base, apex and the prothorax flavous. Clothed with fine, sparse, greyish pubescence and with fine hairs scattered about.

Head with indistinct punctures. Antennæ long, second

to tenth joints more or less acutely serrated. *Prothorax* about once and one-third as wide as long, apex slightly produced in middle, base widely rounded, punctures indistinct. *Elytra* slightly wider than prothorax, sides and suture (except on basal fourth) thickened; with dense and fairly large punctures, smaller about base and apex than elsewhere. *Legs* long; front trochanters subtriangularly produced; front femora semicircularly notched near apex, front tibiæ rather strongly curved at base, and but little more than half the length of hind pair; second and third joints of tarsi very short.

Length 3 mm.

Hab. New South Wales: Sydney, National Park.

In general appearance fairly close to *dispar* and *violaceus*, but front legs, antennæ, and punctures very different. The front legs are somewhat as in *pulcherrimus* and *dentipes*, but the elytra are very differently coloured. In my table of the genus * it would be associated with *mirabilis*, whose elytra are pale at the base as well as at the apex. Scarcely more than the thickened apical margins are pale.

Hypattalus australis, Fairm. Sydney.

H. abdominalis, Er., var. *brevicornis*, Lea. Blackheath.

H. collaris, Lea. Sydney.

Laius nodicornis, Blackb.

Mr. Bryant has sent two specimens (sexes) from Baan Baa (New South Wales) that appear to represent a variety of this species. They differ from the typical forms in being slightly larger, rather hairier, the markings more purplish, the front tibiæ black on their basal external edge, and the prothorax with an irregular dark triangle extending from the base to near the middle.

Laius conicicornis, Blackb. Baan Baa.

L. cinctus, Redt. Sydney, Blue Mountains.

L. hellulus, Guér. Largs Bay, Blue Mountains.

Helcogaster maculiceps, Lea.

Mr. Bryant has a male of this species with a small black longitudinal spot on the prothorax.

Hab. Sydney, Ryde, Illawarra.

* Trans. Ent. Soc. London, 1908, pp. 169-170.

- Helcogaster varius*, Lea. Sydney, Ryde, Illawarra.
H. concaviceps, Lea. Blue Mountains.
H. ruficornis, Lea. Illawarra.
Carphurus armipennis, Fairm. Kuranda.
C. cristatifrons, Fairm. Blue Mountains.
C. cyanopterus, Boh. Blue Mountains.
C. latipennis, Lea. Blackheath.
C. longicollis, Lea. Blue Mountains, Sydney National Park.
C. longus, Lea. Kuranda.
C. vigilans, Lea. Kuranda.
Balanophorus janthinipennis, Fairm. Blue Mountains.
B. brevipennis, Germ. Blue Mountains.

Curculionidæ.

BRACHYDERIDES.

- Prosayleus dispar*, Germ. Largs Bay.
P. hopei, Sch. Sydney, National Park, Blue Mountains, Illawarra.
Evas acuminata, Pasc. Perth.
Maleuterpes spinipes, Blackb. Sydney.
Prypnus squamosus, Blackb. Blue Mountains.
P. 5-nodosus, Gyll. Sydney, National Park.
P. squalidus, Gyll. Blue Mountains.
P. angustus, Lea. Blue Mountains.
Eutinophæa falcata, Lea. Kuranda.
E. variegata, Lea. Kuranda.

OTIORHYNCHIDES.

Timareta setistriata, sp. n.

Blackish, elytra and tip of prothorax of a dingy red; tibiæ, tarsi, and antennæ paler. Densely clothed with whitish scales, varying to a dingy brown, the paler ones sometimes with a greenish or golden or silvery gloss. With numerous

whitish erect or suberect setæ scattered about, and forming a regular row on each elytral interstice.

Head with concealed punctures. Eyes small and coarsely faceted. Rostrum slightly longer than its greatest width, subparallel-sided to near apex; punctures concealed except on the apical triangular plate. Antennæ rather short and stout; club briefly ovate. *Prothorax* decidedly transverse, sides moderately rounded, punctures normally concealed. *Elytra* ovate, thrice the length of prothorax, with regular rows of large partially concealed punctures, becoming smaller posteriorly. *Legs* rather short and stout; tibiæ dilated at apex.

Length 3-3½ mm.

Hab. West Australia: Perth.

With scales and setæ much as on *xanthorrhæa*, but stouter and eyes much smaller. Thus, in that species the space between the eyes is but little more than the extreme length of an eye; in the present species the space between the eyes is fully double the length of an eye. The antennæ are also shorter, with the club more rounded. *Crinita*, also from W. Australia, is a larger species, with thinner antennæ and much less conspicuous setæ, &c. *Subterranea*, *puncticollis*, and *swanseaensis* have very similar eyes and antennæ, but the setæ are in more than one series on each interstice, and the size is usually considerably larger.

Timareta crinita, Pasc. Cottesloe.

T. figurata, Pasc. Cottesloe.

T. pilosa, Blackb. Adelaide.

T. duplicata, Lea. Sydney.

T. granicollis, Lea. Perth.

Merimnetes æqualifrons, Blackb.; var. *compactus*, n. var.

Four specimens (both sexes), taken by Mr. Bryant on the Blue Mountains, differ from ordinary specimens of *æqualifrons* in being shorter and more compact, and with a trifle shorter rostrum. But as I can find no other differences, I have not ventured to give them other than a varietal name.

Myllocerus bilineater, sp. n.

♂. Black or blackish; legs reddish. Densely clothed with white scales, uniform on head, under surface, and legs, but mixed with numerous black spots on elytra; a black

stripe on each side of prothorax. Prothorax and elytra with suberect whitish setæ, on the latter forming a single row on each interstice.

Head flat; a narrow fovea between eyes. *Rostrum* moderately transverse, sides gently incurved to middle, with a narrow median carina and a less distinct oblique one near each side. *Antennæ* moderately long and curved; first joint of funicle slightly longer than second. *Prothorax* strongly transverse, base strongly bisinuate and much wider than apex, which is truncate. *Elytra* not much wider than prothorax; with rows of large almost concealed punctures. *Femora* very feebly dentate.

Length 5-6 mm.

♀. Differs in having eyes rather less prominent, antennæ and legs somewhat shorter, and abdomen more convex.

Hab. N. Territory: Darwin.

In size and shape closely resembles *speciosus*, but the clothing is nowhere green. From *castor* it differs in having the elytra rather narrower, rostrum distinctly shorter, and prothorax wider at the base, with a conspicuous dark stripe on each side. From *pollux* it differs in being somewhat smaller, with the rostrum decidedly shorter and more flattened, and the antennæ somewhat thinner. In my table* of the genus it would be associated with *cinerascens*, from which it differs in the dark patches of scales, in the rostrum being shorter and squarer, and the elytral setæ much more conspicuous. The clothing is much as on *fuscumaculatus*, but the rostrum is considerably wider and prothorax more dilated to base. The femoral teeth are very minute, and could easily be overlooked.

Mylloceris echinatus, Lea. Kuranda.

M. rugicollis, Lea. Kuranda.

Titinia ignaria, Pasc. Baan Baa, Illawarra, National Park.

T. bicolor, Blackb. Baan Baa.

LEPTOPSIDES.

Leptops corrugatus, Pasc. Kuranda.

L. ferus, Pasc. Kuranda.

L. superciliaris, Pasc. Sydney.

* Trans. Roy. Soc. S. Aust. 1905, p. 218.

- Leptops brachystylus*, Lea. Kuranda.
L. fasciculatus, Lea. Kuranda.
L. nigropunctatus, Lea. Quirindi.
Polyphrades nitidilabris, Germ. Spring Vale, Adelaide.
P. nanus, Gyll. Blue Mountains, National Park, Sydney.
P. pardalotus, Pasc. Perth.
P. inconspicuus, Blackb. Mordialloc.
P. tibialis, Blackb. Illawarra.
Mandalotus ventralis, Blackb. Adelaide, Largs Bay.
M. ammophilus, Lea. Illawarra.
M. blackmorei, Lea. Baan Baa.
M. geminatus, Lea. Cairns.
Cherrus plebejus, Oliv. Blue Mountains.
Esmelina flavovittata, Pasc. Blue Mountains.
E. australis, Blackb. Blue Mountains.
Essolithna echimys, Pasc. Mundaring.
Amisollus whitei, Waterh. Ourimbah, Sydney.
Stenocorynus crenulatus, Fab. Kuranda.
S. neglectus, Lea. Kuranda.
Lipothyrea arrowi, Lea. Kuranda.

CYLINDRORHINIDES.

- Perperus melancholicus*, Boi. Blue Mountains.
P. lateralis, Boh. Illawarra.
P. marginalis, Boh. Illawarra.

Lycosura inermis, sp. n.

Light reddish castaneous, head and prothorax sometimes somewhat darker than other parts. Rather densely clothed with white or whitish scales, stouter and denser on sides than elsewhere.

Head with dense, sharply impressed, but partially concealed punctures. Eyes rather large, separated about two-thirds the width of base of rostrum. Rostrum about as long as the width across eyes, slightly dilated from base to apex, punctures much as on head; with a fairly distinct median

carina continued to near apex and narrowly bifurcated in front. Antennæ rather thin; scape rather strongly curved, apex rather strongly thickened, about as long as five following joints combined. *Prothorax* slightly longer than wide, sides evenly rounded, base and apex of equal width. *Elytra* almost twice the width of prothorax, shoulders rounded, sides parallel to beyond the middle and then strongly narrowed to apex; with rows of rather large subquadrate punctures; interstices with small and frequently concealed granules, third with a slight tubercular swelling at summit of posterior declivity. *Legs* rather long; femora stout in middle.

Length $4\frac{1}{2}$ –6 mm.

Hab. W. Australia: Swan River. (*G. E. Bryant and A. M. Lea*).

The antennæ and rostrum are shorter than in *bispinosa*. The elytra are unarmed, but nevertheless there is a slight thickening of the interstices at the positions of the spines of that species. The scales on the sides of the prothorax and elytra are usually of a snowy whiteness and entirely conceal the derm; elsewhere they are much thinner (more or less setose), but looking up the elytra from behind there usually appears to be a distinct white V, caused by the scales on the apical portion of each of the fifth interstices being much as on the sides. The clothing appears to be easily abraded. In some lights abraded specimens appear to have regular rows of large round or rounded watery-looking punctures, much as the submerged punctures on many specimens of *Cordus hospes*. The apparent size of the punctures is much greater than the real. The male differs from the female in being smaller and with a moderately distinct impression at the apex of the first abdominal segment. In the female the two basal segments are also larger and more convex.

MOLYTIDES.

Aphela algarum, Pasc. Sydney.

A. helopoides, Pasc. Cottesloe, Adelaide, Largs Bay.

Psaldus liosomoides, Pasc. Cottesloe, Adelaide, Largs Bay.

GONIPTERIDES.

Oxyops parvicollis, sp. n.

Blackish brown, in places obscurely diluted with red. Densely but irregularly clothed with silvery-white scales, and with snuff-coloured meal, rather dense in places.

Head with small concealed punctures. Eyes prominent, widely separated. Rostrum short and thick, scarcely longer than greatest width, with dense, more or less concealed punctures. *Prothorax* small, about as long as wide, sides moderately rounded, base about one-third wider than apex; with dense, normally concealed punctures, and with remnants of a feeble median carina. *Elytra* much wider than prothorax, shoulders obliquely rounded and with numerous granules, each side near base with an obtuse granulated swelling, apex very obtusely mucronate; with rows of large and usually concealed punctures; third, fifth, and seventh interstices with granulated elevations. *Mesos sternum* with an obtusely pointed intercoxal process. *Legs* stout; tibiæ with numerous small teeth, less distinct on the hind pair than on the others.

Length 10 mm.

Hab. Queensland: Thursday Island.

In general appearance much like a *Gonipterus*, but with the intercoxal process of *Oxyops**. To the naked eye the upper surface appears to be rather densely and irregularly clothed with greyish-white scales, with darker spots on the elytra. The dark spots, however (of which the most conspicuous one appears like a transverse interrupted median fascia, although there is one almost as distinct behind the shoulder), are due partly to the scales there being smaller than elsewhere, but principally to being densely covered with a snuff-coloured meal or powder. The third interstice is obtusely tuberculate near base, with a longitudinal elevation before middle and a shorter one beyond same, the two latter being conspicuously separated by the silvery scales of the fascia. The elevations and granules on the other odd interstices are less conspicuous.

Oxyops grisea, sp. n.

Black. Densely clothed with silvery-white scales, but elytra with a conspicuously mottled appearance.

Head with a deep but partially concealed impression between eyes, elsewhere with small concealed punctures. Eyes prominent and widely separated. Rostrum short, about as long as greatest width (which is near apex); with dense punctures, concealed on basal half. *Prothorax* small, about as long as wide, sides moderately rounded and decreasing in width almost from base to apex; with dense,

* In Proc. Linn. Soc. N. S. Wales, 1897, p. 600, this process was erroneously referred to as if it belonged to the metasternum, instead of to the mesosternum.

partially concealed punctures. *Elytra* oblong-subcordate, apex very obtusely mucronate, shoulders and sides near shoulders as in *parvicollis*; with rows of large more or less concealed punctures; interstices with dense punctures and small granules, mostly concealed; the odd ones feebly elevated in places, but the third rather distinctly sub tuberculate towards base. *Mesos sternum* and *legs* as in *parvicollis*.

Length $9\frac{1}{2}$ mm.

Hab. Queensland: Chillagoe (*H. Hacker*, his 1133).

To the naked eye the elytra appear to be clothed mostly with snuff-coloured scales and to have a distinct median fascia of white scales, with the base and basal portion of the suture white; the dark patches, however, are due partly to the pale scales being very fine and sparse, but principally to a snuff-coloured meal. On the under surface also the meal is fairly dense in parts, but the scales there being rather large, and of almost uniform size, their appearance is not so much altered by it. In general appearance it is much like the preceding species, from which it differs in being somewhat narrower and by a pale fascia replacing the dark median one of that species. Both species (there are two of each before me) have a pale elytral fascia and remnants of others; but on the present species the exact middle of the elytra is covered by it, in the preceding species it is entirely beyond the exact middle. The prothorax has a few small granules showing through the scales; on each side towards the apex there is a feeble longitudinal depression, where the scales are thinner and the meal denser than elsewhere. The shape is somewhat as in *bilunaris*, but the pale band is wider, of different shape, slightly nearer the base, &c. In some respects it is close to the description of *arciferus*, but is larger, rostrum not elongate, median fascia composed of true scales, not at all resembling hairs, eyes distant, &c.

This species is so obviously close to the preceding one that it is advisable that it should be described at the same time, although the types were not taken by Mr. Bryant.

Oxyops concreta, Pasc. Ourimbah.

O. irrasa, Pasc. National Park, Sydney.

O. fasciata, Boi. Quirindi, National Park, Mundaring.

O. reticulata, Boi. Sydney, Blue Mountains.

O. fasciculata, Redt. Sydney.

O. amplipennis, Lea. Blue Mountains.

- Gonipterus suturalis*, Gyll. Sydney, Westport.
G. exaratus, Ths. Sydney, National Park, Ourimbah.
G. gibberus, Boi. Brisbane.
G. rufus, Blackb. Blue Mountains.
G. excavifrons, Lea. Blue Mountains.
G. pulverulentus, Lea. Blue Mountains, Sydney.
Iptergonus cionoides, Pasc. Blue Mountains, Illawarra.
I. aberrans, Lea. Perth.
Bryachus squamicollis, Pasc. Baan Baa, Brisbane.
Syarbis pachypus, Pasc. National Park.
S. porcatus, Lea. Sydney.

HYPERIDES.

- Eurychirus alleni*, Lea. Kuranda.
Prophæsia confusa, Pasc. Sydney.

DIABATHRARIIDES.

- Atelicus inæqualis*, Waterh. Blue Mountains.
Strongylorrhinus ochraceus, Sch. Perth.

ATERPIDES.

Cyllorhamphus tuberosus, Er.

Mr. Bryant took a specimen of this species at Kuranda, the smallest I have ever seen, as it measures but $2\frac{2}{3}$ mm.; others recently taken by myself in the same district measure up to $5\frac{1}{4}$ mm.

ANOMOCIS, gen. nov.

Head rather small. Eyes of moderate size, deeper than wide, widely separated, coarsely faceted. Rostrum fairly stout, lightly curved, shorter than prothorax. Scrobes deep, commencing near apex, where they are visible from above, posteriorly extending to lower margin of eyes. Antennæ moderately stout; scape shorter than funicle; funicle with two basal joints moderately long, the others transverse; club small, subcontinuous with funicle. *Prothorax* about as long as wide; ocular lobes fairly prominent. *Scutellum* minute. *Elytra* suboblong, posteriorly irregular. *Meso-*

sternum with side-pieces of uneven size, the hind ones half the width of the front ones, but the same length. *Metasternum* moderately large, side-pieces distinct, and at front end triangularly produced inwardly. *Abdomen* rather long, sutures deep and straight except between first and second segments in middle, where, however, it is distinct. *Legs* moderately long, front coxæ touching, middle separated by a narrow keel; femora edentate, third tarsal joint wide and deeply bilobed.

A curious genus, specimens of which I have had in my collection for many years. I refer it, with some doubt, to the *Aterpides*, in which it certainly seems out of place. But as the mentum does not fill the area of the mouth, the ocular lobes are distinct, *metasternum* moderately long, with its side-pieces distinct, I do not know where else it could be placed. In the subfamily it may be placed provisionally near *Æsiotes*.

The *Aterpides* certainly contain some very diverse forms—compare, for instance, *Æthemaia* with ocular lobes practically absent, *Aterpus* with unusually prominent ones, *Rhinaria* with sides of rostrum as in *Tanyrhynchides*, and *Æsiotes* with head invisible from above.

Anomocis apicalis, sp. n.

♂. Black. Densely clothed.

Head with dense, normally concealed punctures. *Rostrum* almost the length of *prothorax*; with five conspicuous carinæ from base to antennæ, the median one cleft at its apex, the two on each side connected in front, but moderately separated posteriorly; in front of antennæ with dense and rather coarse punctures. *Antennæ* inserted about one-fourth from apex of rostrum. *Prothorax* rather strongly convex, sides evenly rounded, with large granules and partially concealed punctures. *Elytra* at extreme base not much wider than *prothorax*, but then dilated, with sides subparallel to near apex, then strongly coarctate to apex, with the apex itself obtusely bimucronate; with rows of large, deep, angular, partially concealed punctures; interstices with small tubercles in places, suture, third, fifth, and seventh, each with a moderately large tubercle overhanging the posterior declivity; the declivity itself abrupt, and with several small tubercles. *Under surface* with dense, partially concealed punctures. *Abdomen* with first segment about as long as second and third combined, second as long as third and fourth combined, fifth as long as second to fourth

combined, a narrow basal portion on a level with the preceding segment, but elsewhere irregularly depressed.

Length 10–13½ mm.

♀. Differs in being somewhat wider, abdomen more convex, and apical segment convex in middle and depressed posteriorly.

Hab. New South Wales (*Jas. Kershaw, Sr.*), Sydney (*G. E. Bryant and H. W. Cox*), Jenolan (*A. M. Lea*).

The sculpture of the apical parts of the elytra should prevent this species from being confused with any other member of the family. On the type (and only) male before me the scales are mostly of a sooty or rusty brown, but the elytra are clothed with dirty whitish scales, except for a subtriangular space on the basal third, some small median spots, an abbreviated postmedian fascia, and most of the posterior declivity, where the scales are of the general colour. Each femur has also a pale ring. On the three females the elytral clothing is much as elsewhere. From the sides the head seems to be suddenly depressed below the base of the rostrum. On abrasion the prothoracic granules are seen to be covered with fairly large punctures. The base of each elytron appears to have four small tubercles, of which the outer one is really an abbreviated, oblique, humeral carina. In the male the abdomen at first glance appears to be composed of six segments, of which the fifth is much shorter than the fourth; but this appearance is due solely to the wide and fairly deep depression that covers most of its surface. In the female the base of the fifth is not conspicuously elevated, and its total length is somewhat shorter than in the male.

Aterpus foveipennis, sp. n.

Dark reddish brown, some parts almost black. Head, base of rostrum, under surface and legs densely clothed with dingy, somewhat fawn-coloured scales, prothorax and elytra rather densely clothed at sides, but more sparsely elsewhere. With rather numerous setæ on prothorax, rostrum, and legs.

Head without visible punctures. A narrow impression encircling each eye. Rostrum stout, somewhat elevated in middle. Antennæ stout, first joint of funicle as long as second and third combined, second as long as third and fourth combined. *Prothorax* strongly convex, distinctly longer than wide, produced in front, sides strongly rounded, wider at apical third than elsewhere; with dense large

punctures, each (except on sides) bounded by four granules. *Elytra* much wider than prothorax, with rows of very large punctures or foveæ; interstices much narrower than foveæ, with a few small granules, third and fifth somewhat elevated in places, and in places subtuberculate.

Length $8\frac{1}{2}$ – $10\frac{1}{2}$ mm.

Hab. Queensland: Kuranda.

Readily distinguished from *griseatus*, by the *elytra* being narrower and with very much larger punctures or foveæ; the prothorax is also of different shape and with much larger punctures. The complete absence of fascicles readily distinguishes it from *cultratus*.

Aterpus cultratus, Fab. Blue Mountains.

A. tuberculatus, Gyll. Blue Mountains, Illawarra.

A. griseatus, Pasc. Kuranda, Cairns.

Rhinaria longirostris, sp. n.

Dark reddish brown, some parts darker. Densely clothed with scales varying from almost white to sooty.

Head with dense concealed punctures. Rostrum subquadrangular, more than twice as long as wide, concave along middle, the sides narrowly elevated, with a feeble median ridge near base. Scape about as long as four following joints combined; first joint of funicle about as long as three following combined, second slightly longer than third. *Prothorax* about as long as wide, sides strongly rounded; with numerous granules on disc. *Elytra* with regular rows of large, partially concealed punctures; interstices much wider than punctures, and with a few depressed granules. *Legs* stout.

Length $5\frac{1}{4}$ – $7\frac{1}{4}$ mm.

Hab. New South Wales: Blue Mountains, Ourimbah.

In general appearance much like small specimens of *cavirostris*, but with the rostrum much thinner and almost twice as long. On the under surface and legs the scales are mostly white; on the upper surface they are mostly stramineous. On some specimens there is but slight variation in colour, but on others a vague pale fascia may be traced on the *elytra* before the middle, and before and behind same there are numerous sooty spots, more or less irregularly conjoined. On the prothorax the scales are denser on each side of the base than elsewhere. On the scutellum they are mostly white. On the prothorax there are numerous setæ that rise slightly above the derm; on

the elytra they are stouter and confined to the seriate punctures. Between the eyes, and partly on the base of the rostrum, there is a conspicuous crest, composed of stramineous scales, thickly beset with setæ. On the rostrum there are numerous setæ.

Two specimens from Sydney appear to represent a variety; they differ in being smaller ($4\frac{1}{2}$ – $4\frac{3}{4}$ mm.), and with a vitta of pale scales extending on each side, from apex of prothorax to apex of elytra (on the latter on the fifth to seventh interstices).

Rhinaria rugosa, Boi. Blue Mountains.

R. transversa, Boi. Blue Mountains.

R. cavirostris, Pasc. Kuranda, Brisbane, Illawarra, Blue Mountains, Sutherland.

R. signifera, Pasc. Cairns.

R. tibialis, Blackb. Atherton, Quirindi, Blue Mountains.

R. bisulcata, Lea. Blue Mountains, National Park, Sydney.

R. caudata, Lea. Blue Mountains.

Pelororhynchus angustatus, Ths. Sydney.

P. margaritaceus, Er. Blue Mountains.

P. interstitialis, Lea. National Park, Sydney.

Ethemaia sellata, Pasc. Quirindi.

Hyphæria assimilis, Pasc. Baan Baa.

CLEONIDES.

Lixus immundus, Boh. Kuranda.

L. terminalis, Lea. Kuranda.

HYLOBIIDES.

Alphitopis nivea, Pasc. Sydney.

Orthorhynchus cylindrirostris, Pasc. Kuranda, Brisbane, Sydney, Ourimbah, National Park.

O. klugii, Boh. Sydney, Illawarra.

Meriphus ater, sp. n.

♂. Black, scape partly pale. Clothed with snowy-white scales on each side of prothorax, in front of prosternum,

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middle and sides of mesosternum, and on each side of base of abdomen.

Head not very long; with dense and clearly defined, but rather small punctures. *Eyes* rather large and coarsely faceted. *Rostrum* about once and one-half the length of prothorax, moderately curved, with rows of punctures separated by fine ridges, more distinct behind than in front of antennæ. These inserted about one-third from apex of rostrum. *Prothorax* small, lightly transverse, with rather coarse punctures, in places transversely confluent. *Elytra* strongly convex, about twice the width of prothorax, parallel-sided to middle, and then rapidly diminishing in width to apex; with regular rows of rather large punctures, becoming smaller posteriorly. *Under surface* with rather large, clearly defined punctures. *Femora* stout, front lightly, middle moderately, hind strongly and acutely dentate; hind tibiæ dilated near lower apex.

Length 2 mm.

♀. Differs in having the rostrum somewhat shorter, with ridges not continued in front of antennæ, these somewhat shorter, and the four front femora edentate.

Hab. Queensland: Kuranda.

The eyes are rather coarsely faceted and the femora are aberrant, so that the species was referred to *Meriphus* with considerable hesitation; its deep black colour (in some lights the prothorax and elytra appear to have a vague bluish gloss) and smooth shining elytra are also at variance with others of the genus. Nevertheless, it probably should be treated as an aberrant species of the genus. The spots of snowy scales are very conspicuous. On a male and a female the scape is conspicuously pale at the apex, on another female it is of a dingy brown.

Meriphus guttatus, Pasc. National Park, Illawarra.

MERIPHERELLUS, gen. nov.

Head short. Eyes large, subapproximate, and coarsely faceted. Other characters much as in *Meriphus*.

In Blackburn's table of the Erirhinides, this genus could be placed in the position of *Agestra* (II. II. on p. 150) which has been transferred to the Tychiides. The species described below in general appearance is much like a small *Meriphus*, but the eyes forbid its being placed in that genus.

Meripherellus apicalis, sp. n.

♂. Dark reddish brown; apical third of elytra, antennæ

(club excepted), and tarsi somewhat paler. Sparsely clothed with short, depressed, ashen setæ.

Head with rather coarse punctures. Eyes separated about the width of apex of scape. Rostrum moderately long and gently curved; with rather strong punctures, separated by feeble ridges; but in front of antennæ with small punctures only. Antennæ thin, inserted about one-third from apex of rostrum; scape slightly longer than funicle, first joint of the latter stouter and longer than second; club rather briefly ovate. *Prothorax* small, distinctly transverse, base and apex truncate, sides rounded in middle; with small, dense punctures, and numerous others of larger size. *Scutellum* distinct. *Elytra* about once and one-half the width of prothorax at base, slightly dilated to beyond the middle, and then widely rounded, with rows of large punctures in moderate striæ; interstices with small punctures. *Femora* stout, front lightly, middle moderately, hind strongly and acutely dentate.

Length $1\frac{3}{4}$ mm.

♀. Differs in having the rostrum longer and thinner, with finer punctures, antennæ shorter and inserted not quite as close to apex of rostrum.

Hab. Queensland: Kuranda.

In general appearance something like an *Apion*.

Rhaciodes insignis, sp. n.

Dark reddish brown, almost black, appendages reddish. Each side of prothorax, a large subtriangular patch on elytra, and sides of mesosternum densely clothed with somewhat stramineous scales, with a slight golden or golden-green lustre; elsewhere less conspicuously clothed. Each tubercle with a conspicuous fascicle of blackish setæ.

Head with dense round punctures. Eyes moderately faceted. Rostrum long, moderately curved; punctures somewhat smaller and denser than on head. *Prothorax* slightly longer than wide, sides slightly dilated from apex to base; with dense and irregular punctures and with numerous small transverse rugæ. *Elytra* closely applied to but distinctly wider than prothorax, shoulders rounded, sides subparallel to beyond the middle; with rows of large suboblong punctures, in places almost or quite concealed; near apex with a very large acutely conical tubercle on each side. Legs long; femora stout, subclavate, four front tibiæ distinctly curved; claws divergent.

Length 5-7 mm.

Hab. Queensland : Kuranda (G. E. Bryant) ; Cairns (H. W. Brown and H. Hacker).

Readily distinguished from others of the genus by the elytra having but two fascicles, and these very large and subapical ; each is supported on an acutely pointed tubercle, although the actual point is usually concealed. The sub-triangular patch on the upper surface commences on the middle of prothorax, and is at its widest at its termination (near the subapical tubercles) ; its hind margin is encroached upon by dark scales having a purplish lustre, and which are continuous from the triangle to the apex. Seen from the side the body appears to be deepest at the middle of the under surface and to rapidly slope upwards to each end.

Rhaciodes bicaudatus, Boi. Blue Mountains.

R. granulifer, Chev. Blue Mountains.

R. dentifer, Boh. Sydney.

R. strenuus, Blackb. Kuranda.

Gerynassa nodulosa, Pasc. Illawarra.

Encosmia fasciata, sp. n.

Dark chocolate-brown, legs and antennæ paler. Moderately densely clothed with dingy greyish or sooty scales, variegated in places.

Head with dense partially concealed punctures. *Rostrum* slightly shorter than prothorax, with acute ridges separating rows of punctures from base to antennæ, thence to apex with small punctures only. *Antennæ* inserted about one-third from apex of rostrum. *Prothorax* slightly longer than wide, base slightly wider than apex, sides evenly rounded ; with very dense punctures of moderate size. *Elytra* about one-fifth wider than prothorax and almost thrice as long, base gently arcuate ; with rows of large partially concealed punctures in distinct striae. *Legs* rather short and stout.

Length $2\frac{3}{4}$ mm.

Hab. New South Wales : Ryde.

In build rather close to *adelaidæ*, but clothing very different and rostrum longer ; from the description of *infuscata* it differs very considerably in the clothing. The sides of the prothorax are rather densely clothed with somewhat ochreous scales, the same extending to the shoulders. On the elytra there is a somewhat abbreviated whitish fascia, crowning the summit of the posterior declivity ; the suture

thence to near the apex is clothed with scales, as on the shoulders. On the under surface the scales are denser and white or whitish.

Cassythicola media, sp. n.

♂. Dark reddish brown; legs, antennæ, and sometimes the rostrum paler. Rather densely clothed with scales, varying from whitish, through golden, to sooty.

Head small, punctures concealed. *Rostrum* long and strongly curved, behind antennæ with rows of punctures, in front with sparser and irregularly disposed punctures. *Scape* thin, inserted about two-fifths from apex of rostrum, and somewhat shorter than funicle. *Prothorax* strongly transverse, base much wider than apex, feebly bigibbous in middle; with dense, normally concealed punctures. *Elytra* about one-third wider than prothorax, not much longer than wide, shoulders moderately rounded, the apex strongly so; with rows of fairly large but more or less concealed punctures, each containing a scale. *Legs* short and stout.

Length $2\frac{1}{2}$ –3 mm.

♀. Differs in having the rostrum distinctly longer and thinner, punctures almost absent from in front of antennæ and smaller behind same, antennæ and tibiæ thinner, and clothing more variegated.

Hab. N. S. Wales: National Park, Ourimbah (G. E. Bryant), Gosford (H. W. Cox)*.

In size almost midway between *rotundata* and *longirostris*, but with markings approaching those of the former. Of three males now under examination, the clothing is not similar on any two. Two have five small sooty spots at the base of the elytra, and some vague ones elsewhere; another has the basal spots very obscure, but a rather distinct row of sooty spots across the middle, with paler scales before and after same, and the apex with a large round patch of almost golden scales. The sooty spots are usually feebly elevated, so as to appear like depressed fascicles. On the elytra of the others there are no distinct zones, and the apical half has more or less greyish scales. On the prothorax there is a fairly distinct pale median line and some feeble spots or patches of pale and of dark scales. On the only female before me the clothing is of an almost uniform dingy golden colour.

* There is also a specimen from Wide Bay in the Australian Museum.

Empolis granulatus, sp. n.

♂. Black, antennæ (club darker) and legs more or less of a dingy red. Moderately clothed with white or whitish setæ, becoming thin scales on sides.

Head with dense punctures. *Rostrum* moderately long, thin, and curved; with dense punctures; with a distinct median carina from antennæ to base, and some less distinct ones. *Antennæ* thin, inserted one-fourth from apex of rostrum. *Prothorax* about as long as wide, sides strongly rounded, base slightly wider than apex; with dense round punctures. *Elytra* distinctly wider than prothorax, parallel-sided to beyond the middle; with rows of angular punctures in deep striæ; interstices wider than striæ, with numerous punctures and small granules. *Abdomen* with a vague depression common to two basal segments, with a vague median line filled with somewhat darker setæ than elsewhere from base to apex, second segment distinctly shorter than fifth.

Length $3\frac{3}{4}$ –5 mm.

♀. Differs in having the rostrum longer and thinner, with smaller punctures; antennæ inserted one-third from apex of rostrum; abdomen without a median line, and second segment distinctly longer than fifth.

Hab. New South Wales: Blue Mountains (*G. E. Bryant*), Gosford (*H. W. Cox*).

In general appearance resembling several species of *Desiantha*, but with the generic characters of *Empolis*; from the described species of the latter genus it differs in being considerably larger and very differently clothed. Most specimens have the derm of the upper surface black, but on a few it is more or less distinctly diluted with red. On the under surface of the head and on the front of the prosternum the scales sometimes have a faint golden gloss. The scales nowhere form spots on any of the thirteen typical specimens.

In Mr. Blackburn's table of the Erirhinides *Epacticus* and *Eucosmia* are separated from *Eniopea* and *Empolis* by the fifth abdominal segment being shorter than the second in the former and longer than the second in the latter. These segments, however, are sexually variable. By the table in question the male of *Empolis leai* would be referred to the second group and its female to the first. The same is the case with the present species. The claws have a swelling at the base, but I think the genus was correctly referred to the Erirhinides.

Empolis niveodispersus, sp. n.

♂. Black, legs almost black, antennæ of a dingy red. Moderately clothed with somewhat golden or dark stramineous setæ or thin scales, elytra in addition with some round snowy-white scales scattered about, sometimes singly, sometimes in small spots; under surface and legs with whitish clothing.

Head with dense punctures. Rostrum moderately long, thin, and curved; with dense punctures; with three distinct carinæ from antennæ to base. Antennæ rather thin, inserted about one-third from apex of rostrum. *Prothorax* moderately convex, almost as long as wide, sides strongly rounded, base and apex subequal; with dense round punctures. *Elytra* about one-third wider than prothorax, parallel-sided to beyond the middle; with rows of large partially concealed punctures in deep striæ; interstices wider than striæ, with more or less concealed punctures and granules. *Abdomen* with a shallow depression, filled with stramineous setæ along middle of two basal segments, second distinctly shorter than fifth, the setæ at its apex appearing like a small fascicle.

Length $4\frac{1}{4}$ mm.

Hab. New South Wales: Illawarra.

In build rather close to the preceding species, but readily distinguished from it and from all others of the genus by the large snowy scales in the elytral striæ.

Desiantha maculata, Blackb. Mordialloc, Adelaide.

D. malevolens, Lea. Mundaring.

Eniopea bivittata, Lea. Illawarra, National Park.

Ethas eruditus, Blackb. Illawarra.

E. varians, Blackb. National Park, Sydney.

Epamæbus scutellaris, Blackb. Illawarra.

E. ziczac, Lea. Illawarra.

Cyttalia sydneyensis, Blackb. National Park, Sydney.

Symbothinus squalidus, Blackb. Baan Baa.

Nemestra incerta, Pasc. Perth.

Eristus uniformis, sp. n.

Dull reddish castaneous, antennæ and legs slightly paler, moderately clothed with short, depressed, whitish setæ

below eyes, at sides of prothorax and of under surface, and at base of elytra; elsewhere almost or quite glabrous.

Head with numerous rather small punctures; with a small interocular fovea. *Rostrum* wide, slightly shorter than prothorax, moderately curved; punctures on basal half as between eyes, but becoming smaller and more numerous towards apex. *Scape* inserted slightly nearer apex than base of rostrum, about half the length of funicle and club combined; first joint of funicle stouter and slightly longer than second. *Prothorax* moderately transverse, sides strongly rounded, base distinctly wider than apex; with rather dense round punctures. *Elytra* suboblong, about one-third wider than prothorax, apex widely rounded; with narrow striae containing distinct punctures; the interstices each with a row of setiferous punctures. *Legs* rather short and stout.

Length 3-3½ mm.

Hab. New South Wales: National Park, Illawarra (*G. E. Bryant*).

Differs from *pallidus* in being larger, somewhat darker, rostrum longer, no paler than the prothorax, the latter with sides more rounded, clothing sparser, &c. From *blackburni*, to which, perhaps, it is closer, it differs in being larger, rostrum distinctly longer, no part of under surface dark, and clothing sparser. The three typical specimens are probably females.

A specimen from Sydney differs in being considerably paler, elytra slightly stained at about one-fourth from apex, with the apical fourth paler than the rest of the elytra. It is probably immature.

Eristus setosus, Blackb. Baan Baa, Brisbane.

E. bicolor, Blackb. National Park.

E. pallidus, Lea. National Park, Illawarra, Sydney.

ERISTINUS, gen. nov.

Rostrum quite straight. Suture between first and second abdominal segments extremely faint across middle. Other characters as in *Eristus*.

Eristus was referred with considerable hesitation (principally on account of the wide rostrum) to the Eirrhinides by Mr. Blackburn. Probably it would have been with still more hesitation that he would have referred the present genus to the Eirrhinides, if he had done so at all. Certainly, however, it is very close to *Eristus*, and it was only after considerable hesitation that I decided to describe the three

species as other than aberrant members of that genus. The rostrum, when seen from the side, appears to be very thin (much thinner than in *Eristus setosus* or *bicolor*), but from in front appears to be very wide. Four specimens of *eucalypti* have their mandibles unclenched, and these are seen to be acutely bidentate at the apex.

Only one specimen of the genus was sent by Mr. Bryant, but I have associated with it another species of which there are several specimens under examination, and another also represented by a single specimen. They may be tabulated as follows:—

Eyes close together and elytra glabrous	<i>eucalypti</i> .
Eyes moderately separated and elytra clothed.	
Legs uniformly pale	<i>flavipes</i> .
Femora much darker than tibiæ and tarsi	<i>sobrinus</i> .

Eristinus eucalypti, sp. n.

♂. Black; rostrum, antennæ, and legs flavous. With some whitish hairs on head, prothorax (the disc glabrous), and under surface; dense only on sides of meso- and of metasternum.

Head with a few distinct punctures near eyes. Eyes large, close together, and coarsely faceted. Rostrum wide, thin, and almost parallel-sided, about twice as long as wide; with distinct but not very dense punctures. Scape short, somewhat curved, much shorter than funicle; first joint of the latter stout and moderately long. *Prothorax* moderately transverse, sides evenly rounded, base lightly bisinuate and not much wider than apex; with numerous punctures of rather small size, clearly defined on disc, but obscured on sides. *Scutellum* small but distinct. *Elytra* much wider than prothorax and about thrice as long, shoulders feebly rounded, sides slightly dilated to beyond the middle, and then widely rounded to apex; with rows of punctures, fairly large at the base, but becoming much smaller posteriorly. *Abdomen* with small punctures, two basal segments rather large, in male flattened across middle, in female convex, second, third, and fourth directed slightly backwards at sides. *Legs* rather short and stout; femora edentate.

Length $1\frac{1}{2}$ –2 mm.

Hab. New South Wales: Gosford, on *Eucalyptus piperita* (H. W. Cox), Ourimbah (Taylor Bros.). Queensland: Mount Tambourine (C. J. Wild).

The elytra are quite glabrous; their punctures are in regular rows, but not striæ, although in places traces of same may be noticed.

Eristinus flavipes, sp. n.

Black; rostrum, antennæ, and legs flavous; head, disc of prothorax, apex, and shoulders of elytra diluted with red. Clothed with rather sparse whitish hairs, moderately dense only at sides of meso- and of metasternum; elytra with very short but fairly distinct pubescence.

Head with fairly numerous distinct punctures. Eyes separated almost the width of rostrum at base. Rostrum shaped as in preceding species, basal half with fairly numerous distinct punctures, as those between eyes, but smaller elsewhere. *Prothorax* with dense and rather coarse punctures, and an irregular median line. *Elytra* with rows of distinct punctures, rather coarse at base, and becoming smaller posteriorly; the interstices each with a row of small but distinct punctures.

Length $1\frac{1}{2}$ mm.

Hab. New South Wales: Sydney.

In general appearance close to the preceding species, but with much coarser punctures (except on under surface) and elytra with fine but fairly distinct clothing, and with striation more defined, although still very feeble; the legs are also somewhat thinner.

Eristinus sobrinus, sp. n.

Dark reddish brown; antennæ (club darker), tibiæ, and tarsi of a rather dingy flavous. Clothed with whitish pubescence, shorter on elytra and denser on sides of meso- and of metasternum than elsewhere.

Head and rostrum with sculpture much as in preceding species. *Prothorax* with very dense and rather coarse punctures; without a median line. *Elytra* parallel-sided to beyond the middle; with rows of large round punctures, becoming smaller posteriorly; interstices each with a row of small but distinct punctures.

Length $1\frac{1}{2}$ mm.

Hab. Queensland: Cairns (C. J. Wild).

A dingy species readily distinguished from the others by its dark femora; the punctures on its under surface are also coarser. Its prothoracic punctures are rather smaller than in the preceding species, but denser. The rows of punctures on the elytra are very distinct, but the striation is feeble.

Antyllis variabilis, sp. n.

Reddish castaneous, tip of rostrum, club, and claws darker.

Densely clothed with whitish, ochreous, and sooty scales, with numerous erect, dark, and rather short setæ, scattered about on head, prothorax, and elytra.

Head with dense punctures, concealed in front. *Rostrum* about the length of prothorax, lightly curved; basal half with five carinæ separated by rows of punctures, apical half with moderately dense but not seriate punctures. *Antennæ* inserted slightly nearer apex than base of rostrum, first joint of funicle stout and moderately long. *Prothorax* almost as long as wide, sides rather strongly and evenly rounded, base decidedly wider than apex; with dense, round, concealed punctures. *Elytra* oblong-cordate, much wider than prothorax, with rows of large, partially concealed punctures; interstices wide, with small, dense, normally quite concealed punctures. *Legs* rather long; femora stout.

Length $2\frac{1}{2}$ –3 mm.

Hab. New South Wales (*Macleay Museum*), National Park (*G. E. Bryant*). Tasmania: Huon River, Mount Wellington (*A. M. Lea*).

In general appearance not at all close to the two previously named species (*togata* and *alternatis*) known to me. In its elytral setæ it approaches the description of *setosa*, but the two species appear to have little else in common. The male differs from the female in having the rostrum slightly stouter, legs slightly longer, and basal segment of abdomen widely depressed, instead of strongly convex, in middle.

On the prothorax there are three lines of whitish scales, the surface elsewhere being clothed with more or less ochreous ones. On the elytra the white scales clothe the suture (more noticeably towards the base than elsewhere) and are fairly dense about the middle, but with a linear arrangement; the sooty scales form an elongated spot on the second interstice near base, another beyond the middle, and a third near apex, on the fourth there is an elongated median spot, and on the sixth a small spot just before the middle, but on some specimens there are no dark spots, or only two or four on each elytron. On the rest of the elytra the scales are ochreous, sometimes with a golden, sometimes with a reddish, gloss. On the under surface the scales are usually whitish, sometimes with a greenish gloss. On an occasional specimen the erect setæ are nearly white.

On some of the Tasmanian specimens the dark markings on the elytra are rather more conspicuous than usual, there being elongated median spots on all the even interstices, and

occasionally one on the seventh near apex, in addition to the other two on the second. On one specimen all the median and subapical spots are irregularly joined. These specimens also have rather numerous elongated white spots on the elytra.

Omorophius coxii, sp. n.

♂. Bright reddish castaneous. Densely clothed with more or less ochreous scales, variegated with paler and darker ones on elytra, and paler on under surface.

Rostrum long, thin, and moderately curved, with numerous punctures, irregular in front of antennæ; seriate in arrangement and separated by distinct ridges behind same, becoming concealed towards base. Antennæ thin, inserted at about one-third from apex of rostrum; first joint of funicle as long as the three following combined. *Prothorax* rather small, almost as long as wide, sides rather strongly rounded, base distinctly wider than apex; with dense, concealed punctures. *Scutellum* minute. *Elytra* about once and one-half the width of prothorax, and fully thrice as long; with rows of large, almost concealed punctures, in feeble striae. *Legs* moderately stout.

Length $3\frac{1}{2}$ –4 mm.

♀. Differs in being somewhat stouter, rostrum longer, thinner, and with smaller punctures; antennæ inserted nearer the middle of rostrum; and abdomen with two basal segments rather strongly convex, instead of flattened in middle.

Hab. New South Wales: Ryde (*G. E. Bryant*), Gosford (*H. W. Cox*).

In general appearance fairly close to *nigrovarius*, from Western Australia, but larger and somewhat wider, elytral markings different, and metasternum not black. From *seriatus* (described originally as from Gosford), it differs in being smaller, with conspicuous elytral markings, &c. The scales are usually darker on the middle of the prothorax than on the sides. On each elytron there is a pale, oblique, irregular fascia, extending from the side before the middle to near the suture at the apical third. On the side before and beyond the fascia the scales are usually sooty, and there is an irregular sooty spot on the middle just before the fascia, and sometimes a smaller one just beyond it. On the under surface the scales have sometimes a golden or greenish glow. In addition to the scales there are some stout depressed setæ on the prothorax and elytra, but they are indistinct from most directions.

PHAUNÆUS.

This genus was doubtfully referred to the Zygopides. A re-examination of the characters of the types, together with those of a second species taken by Mr. Bryant and a third from the Macleay Museum, convinces me that the genus should probably be referred to the Eirrhinides. The scrobes were originally described as "lateral," but they are rather peculiar, being obliquely and rapidly turned under the rostrum. On each side above the scrobe and having a common starting-point with it, there is a distinct groove, continuous to the eye, that at first appears to be the real scrobe (much as in *Rhachiodes* and *Eucosmia cornuta*, but not in the other species of the latter genus), and is alike in all three species.

Regarding the genus as belonging to the Eirrhinides, in Mr. Blackburn's table of the genera of that subfamily, the falcate front tibiæ would associate it with *Ænochroma* and *Olbiodoros*, from both of which it is readily distinguished by the short claw-joint. It is really, however, not very close to either of those genera, nor to any other of the subfamily known to me.

Phaunæus trilinealbus, sp. n.

Black, shining. White scales forming three narrow lines on prothorax (the lateral ones not quite to base, the median one not quite to apex), narrowing, clothing the suture at base and apex, dense on parts of sterna, forming a line on the under surface of each of the four front femora, and on the upper surface of the hind four, and fairly dense on tarsi and tips of the tibiæ. Numerous black setæ on legs and on parts of the upper surface.

Head with fairly dense small punctures. Rostrum thin, slightly longer than prothorax; with dense punctures, behind the antennæ seriate in arrangement, and on the sides separated by acute ridges. Antennæ inserted about one-fourth from apex of rostrum, two basal joints of funicle moderately long, first longer and stouter than second. *Prothorax* strongly convex, slightly longer than wide, sides evenly rounded; with dense, clearly defined punctures of moderate size. *Elytra* subcordate, strongly convex, about once and one-half the width of prothorax, with rows of deep punctures in narrow striæ. *Legs* long; front tibiæ strongly curved.

Length $2\frac{1}{2}$ –3 mm.

Hab. New South Wales: Illawarra.

Differs from *longirostris* in the rostrum being distinctly shorter than the elytra ; prothorax less dilated to the base, and with three conspicuous lines of white scales, &c. The resemblance to species of *Idotasia* is much less pronounced, but the scrobes, lateral sulci, and legs convince me that the species should be generically associated with *longirostris*. On the side of each elytron there is a row of punctures in a stria, then three seriate rows, and then rows in regular striae to the suture.

There are three specimens of this species in the British Museum from the Richmond River, but they have been rather dirty and the prothoracic stripes from one have been abraded, and partially so from the others.

Phaunæus medioalbus, sp. n.

Black, shining ; parts of antennæ and of tarsi obscurely diluted with red. White scales forming a continuous median line on prothorax, several spots on elytra, dense on middle of sterna and of basal segment of abdomen, and irregularly distributed on legs.

Head with dense, clearly defined punctures. Rostrum moderately thin, slightly longer than prothorax, moderately curved, with fairly large punctures, more or less seriate in arrangement behind antennæ. These inserted about one-third from apex of rostrum ; first joint of funicle as long as second and third combined. *Prothorax* strongly convex, distinctly longer than wide, sides rather strongly rounded, with dense and rather coarse punctures. *Elytra* subcordate, almost twice the width of base of prothorax, with rows of deep punctures in narrow striae, the seventh and eighth rows not in striae. *Legs* long, four front tibiae strongly curved.

Length $2\frac{1}{4}$ – $2\frac{1}{2}$ mm.

Hab. Queensland : Cairns, Endeavour River (*Macleay Museum*).

In build, except that it is smaller, rather close to the preceding species, but clothing different and prothoracic punctures distinctly larger. The white scales appear to be rather easily abraded, as the median line of the prothorax is sometimes traceable only at its ends ; on each elytron there are normally three spots : two about middle, on the second and third interstices, and one at apex, but occasionally they are all absent.

Cydmæa suturalis, sp. n.

Black. Densely but irregularly clothed.

Rostrum moderately long, feebly diminishing in width from base to apex, with rows of rather strong punctures, partially concealed towards base, becoming small towards apex. *Antennæ* inserted slightly nearer apex than base of rostrum; basal joint of funicle stout, longer than second and third combined. *Prothorax* lightly transverse, sides evenly rounded, with dense, partially concealed punctures. *Elytra* oblong-cordate, about one-fourth wider than prothorax; with rows of rather large and mostly concealed punctures. *Legs* rather stout; front coxæ touching.

Length 2 mm.

Hab. New South Wales: Sydney.

In the table of species previously given by me*, it would be associated with *dorsalis* and *fasciata*, to neither of which, however, is it at all close. The clothing is something like that of some forms of *rostralis*, but the pale scales cover less of the surface, and the rostrum is very different; *diversa* has the clothing somewhat different, and front coxæ not touching. The pattern is somewhat suggestive of that of small specimens of *eucalypti*, but the rostrum is deep black. On the upper surface the scales are mostly whitish, with an ochreous tinge, but some in certain lights have a golden gloss; between the eyes from some directions, a few appear to be of a fiery red. In places there are black scales and semi-nude spaces, so that the surface appears to be covered with scattered, angular, pale spots; but there is a fairly large spot on each side of the base of prothorax, and an irregular postmedian fascia may be traced on the elytra, the suture also is clothed throughout. On the under surface the scales are denser, paler, and more uniform.

Cydmæa tibialis, sp. n.

♂. Reddish castaneous; prothorax and under surface black. Densely squamose.

Rostrum and antennæ as in preceding species. *Prothorax* about as long as wide, basal half parallel-sided, with dense, normally concealed punctures. *Elytra* oblong-cordate, rather long for the genus, not much wider than prothorax, with rows of rather large, oblong, partially concealed punctures. *Legs* rather stout; front coxæ touching, front

* Trans. Roy. Soc. S. Aust. 1899, p. 152.

tibiæ at apical third with a small tooth, emarginate between same and apex.

Length $2-2\frac{1}{4}$ mm.

♀. Differs in having the abdomen more convex, and the front tibiæ simple.

Hab. New South Wales : Sydney.

In the table, referred to under the preceding species, would be associated with *eucalypti* and *nymphoides*, two Western Australian species, to neither of which is it at all close in appearance. On the upper surface the scales are mostly white or whitish, but in places stained with ochreous. On the prothorax there are several dark spots, partly due to several semi-nude spaces, and partly to dark scales ; on the elytra there is a fairly distinct postmedian fascia of pale scales. On the under surface the clothing is dense and uniformly white or silvery.

Cydmæa dorsalis, Lea.

Mr. Bryant captured a single specimen of this species near Sydney. The types were from W. Australia.

Cydmæa mixta, Blackb. Sydney, National Park.

C. major, Blackb. Sydney, Blue Mountains.

C. viridula, Pasc. Swan River.

C. rostralis, Lea. Swan River, Mundaring.

C. binotata, Lea. Illawarra.

Dicomada rufa, Blackb. Sydney, Blue Mountains.

Thechia cinerascens, Lea.

A specimen from Sydney differs from the type (from Tasmania) in being slightly smaller, and with the markings even less pronounced.

Thechia pygmæa, Pasc. Baan Baa.

Misophrice submetallica, Blackb. National Park.

M. setulosa, Blackb. Illawarra.

M. variabilis, Blackb. Perth.

M. alternata, Lea. Sydney, Illawarra.

M. apionoides, Lea. Sydney, Illawarra.

Misophrice gloriosa, Lea. Sydney, Blue Mountains, Ourimbah.

M. squamiventris, Lea. Sydney, Illawarra.

M. viridisquama, Lea. Sydney.

Storeus albosignatus, Blackb. National Park, Sydney, Illawarra.

S. majusculus, Blackb. Illawarra.

S. cryptorhynchus, Lea. Sydney, National Park.

S. invidiosus, Lea. National Park.

S. niveiceps, Lea. National Park.

Balenerhinus problematicus, Lea. Kuranda.

Aoplocnemis guttiger, Pasc. Blue Mountains.

AMALACTIDES.

Tranes roei, Boh. Mundaring.

EURHYNCHIDES.

Eurhynchus splendidus, Blackb. Kuranda.

Chalcocyhelus bispinosus, Boi., var. *australis*, Heller. Kuranda.

[To be continued.]

XXXVII.—*The Geographical Races of Citellus fulvus.* By OLDFIELD THOMAS.

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THE British Museum contains examples of the yellowish Kirghiz and Transcaspian souslik, *Citellus fulvus*, from the three most extreme points of its range, namely the Kirghiz Steppes south of the Urals, Bokhara, and Meshed, N.E. Persia, the last being a locality not hitherto recorded for the animal.

A comparison of the specimens shows enough difference between those from each locality to justify their being considered distinct subspecies.

Ann. & Mag. N. Hist. Ser. 8. Vol. xv. 28

The type of "*Arctomys fulvus*" * was obtained by Eversmann on the River "Kuwandschur," and a study of the traveller's itinerary † indicates that this place was some 50-80 miles north of the Aral Sea, therefore clearly in the region of what would be called Kirghiz Steppes. I therefore propose to take our Kirghiz specimens as representing the typical race.

These specimens are unfortunately only dealers' skins, not well prepared, and without exact particulars, so that the detailed characters are not easily made out on them. But as gauged by the skull they are so much larger than the Bokharan and Persian races as clearly to indicate subspecific distinction.

The skull-measurements of an adult male are as follows :—

Greatest length 61 mm.; condylo-incisive length 56·8; zygomatic breadth 41·5; nasals $22\cdot5 \times 9\cdot8$; interorbital breadth at notch 12·2; palatilar length 33·5; upper tooth-row 15·4; molars only 10·2.

In general colour *C. fulvus fulvus* is like the Bokharan subspecies described below, much more strongly fulvous throughout than in *C. f. parthianus*, and the tips of the caudal hairs similarly buffy, not white; the tail below with a well-marked layer of bright ochraceous-buffy hairs.

The other two subspecies may be distinguished as follows :—

Citellus fulvus oxianus, subsp. n.

Size decidedly less than in true *fulvus*. General colour, on the whole, very much as in that form, the back near "warm-buff" of Ridgway, the head rather greyer but not conspicuously so. Sides creamy buff. Under surface buff, the bases of the hairs blackish slaty, but on the throat the hairs are buffy with whitish bases; across the chest and on the whole of the forearms the colour is warmer buff, approaching cinnamon-buff; hands more greyish buff, like head. Hind limbs buffy on outer side and on feet, warmer cinnamon buffy on inner side. Tail with the rich cinnamon-buff of the underside hiding the black subterminal bands of the upper hairs except at the end, so that in its lower aspect the tail appears rich buffy, with pale buffy edging and subterminal black bar

* Licht. in Eversm. Reise nach Buchara, p. 119 (1823).

† *T. c.* pp. 28-29.

on the pencil; on the upperside, however, the dark subterminal bands on the hairs are seen to pass some way up each side of the tail; tips of all the hairs buffy.

Skull decidedly shorter and proportionally rather broader than in *fulvus*.

Dimensions of the type (measured in flesh):—

Head and body 240 mm.; tail 94; hind foot 46.

Skull: greatest length 54; condylo-incisive length 51; zygomatic breadth 40·5; nasals $21 \times 8\cdot6$; interorbital breadth 10; palatilar length 28; upper tooth-row 13·7; molars only (worn) 9.

Hab. Bokhara and Samarkand. Type from 50 miles S.W. of Bokhara. Alt. 600'.

Type. Old female. B.M. no. 9. 4. 3. 26. Original number 40. Collected 19th March, 1908, by Douglas Carruthers. Six specimens.

Citellus fulvus parthianus, subsp. n.

Size about as in *C. f. oxianus*. Colour above a rather warmer and more cinnamon-buff, though the difference is not great. Head and nape distinctly greyer than the back, the difference greater than in *oxianus*. Under surface much greyer than in *oxianus*, the ends of the belly-hairs light or creamy instead of cinnamon buff. Inner side of limbs more buffy than the underside generally, but not nearly so strong a buff as in *oxianus*. Tail with scarcely any of the strong cinnamon-buffy hairs on its underside, so that, as a consequence, the pale buffy bases and black subterminal band of the upper and lateral hairs are visible from below; tips of the hairs white or whitish.

Skull about as in *oxianus*.

Dimensions of the type:—

Head and body (c.) 240 mm.; tail 38; hind foot 47.

Skull: greatest length 57; condylo-incisive length 53·7; zygomatic breadth 40·3; nasals $20\cdot6 \times 8\cdot7$; interorbital breadth 10·7; palatilar length 29·5; upper tooth-row 15·2; molars only 10·1.

Hab. N.E. Persia. Type from Meshed, alt. 3000'. One specimen from Kain.

Type. Adult male. B.M. no. 8. 6. 10. 2. Collected April 1908, and presented by Col. P. M. Sykes. Six specimens in all, presented by Col. Sykes, Col. Yate, and Major Watson.

This Persian subspecies differs from *C. f. oxianus* by its

warmer colour above, greyer and less buffy tone below, including the almost complete absence of the strong buffy of the inner side of the forearms, by the more creamy tone of the belly, and by the whitish instead of buffy tips to the caudal hairs.

Col. Sykes tells me "These ground-squirrels appear in April, and have no cover for about a month. After that they disappear into the crops, and are rarely seen outside. Those I sent you were certainly killed in April, and probably all the others."

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

February 24th, 1915.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The following communication was read:—

'The Ashgillian Succession in the Tract to the West of Coniston Lake.' By John Edward Marr, Sc.D., F.R.S., F.G.S.

The Author has studied in detail the succession of the Ashgillian strata in Ashgill Beck and the adjoining tract. In Ashgill Beck the following sequence was detected:—

VALENTIAN.		Thickness in feet.	
ASHGILLIAN	Upper...	Ashgill Shales.....	about 50
	Middle {	<i>Phacops-mucronatus</i> Beds.....	16
		Ash	16
		White Limestone	about 12
	Lower...	<i>Phillipsinella</i> Beds	7

CARADOCIAN.

An account of the lithological characters and lists of the fossil contents of the various divisions are given, and confirmatory sections from Coniston Village to Appletreeworth Beck are described. A comparison is made with the beds of the Cautley district, previously described by the Author. Some fossils which have not yet been found in the Lower Ashgillian of the Cautley district occur in the beds of that division at Coniston.

From a study of the fossils of the Coniston tract and of other areas in Britain and the Continent, it would appear that a two-fold division of the Ashgillian strata which is of more than local value may be made. The lower division is characterized by the abundance of *Phillipsinella parabola*, and the upper by the profusion of *Phacops mucronatus*.

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THE ANNALS

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MAGAZINE OF NATURAL HISTORY.

[EIGHTH SERIES.]

No. 89. MAY 1915.

XXXVIII.—*Notes on the Coleopterous Family Dermestidæ, and Descriptions of some new Forms in the British Museum.* By GILBERT J. ARROW.

(Published by permission of the Trustees of the British Museum.)

THE catalogue of this family of beetles compiled by Dalla Torre and published in 1911, while of the greatest value as an indispensable preliminary to the systematic study of the group, is necessarily uncritical and in many respects defective from the fact that the compiler has no intimate knowledge of the insects with which it deals. While studying and arranging with its help the British Museum collection of Dermestidæ, I have recorded for the information of future workers the various corrections and omissions which have come under my notice ; and these are published here, together with descriptions of some of the new species in the collection which appeared specially worthy of receiving names.

With an extraordinary degree of variability in the formation of the antennæ, and, to a less extent, in other points of structure, these insects have a general similarity which rarely leaves any doubt as to their belonging to the family. The most important and distinctive feature is the existence of a frontal ocellus, which is absent in the genus *Dermestes* only. This interesting feature is only known in one other family of Coleoptera—the Staphylinidæ (subfamily Omaliinæ),—for the statements that it is found in the genera *Pteroloma* and *Hylecætus* are quite erroneous.

Genus DERMESTES.

The types of various so-called species in the British Museum and the Oxford University Museum have never hitherto received any critical examination. That of *D. roei*, Hope, is unfortunately not to be found at Oxford, but of the other two described by Hope I have ascertained that *D. elongatus* belongs to *vulpinus*, F., and *D. pollinctus* to *frischii*, Hugel.

D. elongatus, Lec., is not, as suggested by Jayne, the same as the European *D. bicolor*, F., a much shorter insect. As Leconte's name was preoccupied by Hope, I propose to call the species

Dermestes nidum (nom. nov.),

Mr. H. S. Barber having recorded (Proc. Biol. Soc. Washington, xxvii. 1914, p. 146) the fact that it breeds in the nests of a heron.

D. felinus, F., of which the type is in the British Museum, is *Dermestes cadaverinus*, as is also *D. subcostatus*, Murray. *D. tessellatus*, F., although it has not yet been eliminated from the catalogues, was found long ago to be an *Anobium* (*rufovillosum*, Deg.).

The North-American *D. dissector*, Kirby, belongs to the European species *D. undulatus*, Brahm, and the Central-American specimens referred by Sharp in the 'Biologia Centrali-Americana' to *D. mannerheimi* are in reality *D. caninus*, Germ., of which we have specimens also from Panama, Cuba, and St. Domingo.

Genus ATTAGENUS.

Many Dermestidæ, as is well known, have an exceedingly wide area of distribution, and are at the same time extraordinarily variable in their more superficial features. The synonymy due to this fact has by no means all been recorded yet. One of these cosmopolitan species is that named *Æthriostoma undulata* by Motschulsky. This proves to be the same as the Australian *Brachysphyrus irroratus* of Blackburn, the type of which (now in the British Museum) is a female. Blackburn's names must both disappear accordingly. Another synonym for the same insect is *Attagenus rufipes*, Walker. The name *Æthriostoma* is also redundant, for it cannot be distinguished generically from the species of *Telopes*, which is at present treated as a subgenus of *Attagenus*. *A. undulatus* is evidently a common insect; I have seen specimens from Ceylon, India, Singapore, Hongkong,

Philippine Is., Madagascar, Mauritius, etc. Mr. E. E. Green has found it buzzing round the trunks of *Spondias magnifera* trees in Ceylon.

A. gloriosæ, F., is not very nearly related to the last species, as Motschulsky has stated. *A. plebejus*, Sharp, is synonymous with *gloriosæ*.

A. cylindricus, Kirby, by an oversight has been catalogued by Dalla Torre as a synonym of *A. piceus*, as well as in its right place in *Perimegatoma*.

Similarly, *Anthrenus exilis*, Muls., has got into the Catalogue amongst the species of *Attagenus*, as well as in its proper place.

A. lætus, Péring., is *A. hottentottus*, Guér.

A. cyphonoides, Reitter, according to specimens named by him in our collection, has a produced prosternum, and must be transferred to the genus *Trogoderma*.

Attagenus japonicus, Reitt., was compared by its author to *A. marginicollis*, and distinguished only by an almost intangible colour-difference. *A. marginicollis* and other forms hitherto separated from it have since been sunk by Reitter himself in his 'Catalogue of the European Coleoptera' as synonymous with the wide-ranging *A. piceus*, Oliv. No reason remains, therefore, for retaining *A. japonicus* as more than a race of that insect.

The following new species belong to this genus :—

Attagenus pardus, sp. n.

Niger, pedibus rufis, corpore supra et subtus dense flavo-cinereo-pubescenti, singuli elytri maculis tribus (aliaque communi media) magnis subcircularibus denudatis, maculis posticis duabus conjunctis, apicalibus, majoribus, medio cinereo-pupillatis; corpore oblongo-ovali, valde convexo.

Long. 3·5–4·5 mm.; lat. 2–2·5 mm.

Hab. RHODESIA: Salisbury (*G. A. K. Marshall*).

This very distinctively marked species is entirely covered with greyish-yellow hair, with the exception of seven nearly round areas upon the elytra, which are quite black, bare or clothed with much finer pubescence than the rest of the upper surface. One of these patches is placed at the middle of the elytral suture and the others are arranged in a circle round it, one behind the scutellum on each side, one at the outer margin and one occupying the sutural angle, the last larger than the rest and having a central spot of grey pubescence.

It is a convex insect of elongate-oval shape. The club of

the antenna is three-jointed and short, the terminal joint not longer than it is broad. It is an allied species to *A. jucundus*, Péring., but more compact and convex, more closely pubescent, without markings on the pronotum and with quite peculiar detached round spots on the elytra.

Attagenus nigripennis, sp. n.

Niger, pedibus et antennis rufescentibus, harum clava nigra, pronoto, corpore subtus pedibusque fulvo-vestitis, elytris minutius et haud perspicue pubescentibus; ovalis, modice elongatus, dense, fortiter et distincte punctatus, pronoto postice valde lobato, antennarum clava modice elongata, articulo ultimo fœminæ parvo, maris longitudine ad duos præcedentes æquali.

Long. 3-3.5 mm.

Hab. GOLD COAST: Aburi.

A specimen of each sex was taken by Mr. W. H. Patterson.

The common *Attagenus piceus*, Oliv., is found in Europe, Asia, and America, but has not so far been brought from any part of Africa. The new species closely resembles it, but the puncturation of the upper surface is rather stronger and more distinct, and the hairs clothing the pronotum are long and bright yellow in colour. The basal lobe of the pronotum is much more produced, and the club of the antenna is black in both sexes (it is red in the female of *A. piceus*) and has a much shorter terminal joint in the male. In the female the last joint is smaller than either of the two preceding it.

Attagenus birmanicus, sp. n.

Niger, sed flavo-pubescent, pedibus antennisque rufis; elongato-ovalis, parum convexus, antennarum clava triarticulata, articulis subæqualibus, maris laxius connexis.

Long. 2-3.5 mm.

Hab. UPPER BURMA (*Gray*); Tharrawaddy (*G. Q. Corbett*).

Presented by Mr. H. E. Andrewes.

This closely resembles the widely distributed *A. piceus*, Oliv., but is smaller on the whole, and the hair with which it is clothed is pale yellow both above and beneath. The posterior lobe of the pronotum is much stronger and the scutellum therefore less exposed. The club of the antenna is quite different, the three joints composing it being nearly equal in both sexes and much more loosely articulated in the male, in which the two basal ones are a little longer than

wide and the last not quite twice as long as wide. In the female the basal joint is as long as wide, the middle one transverse, and the last half as long again as it is wide. The male is much smaller than the female.

Genus TROGODERMA.

Trogoderma inclusum, Lec., is apparently the common European *T. versicolor*, Creutz., a cosmopolitan insect, although not recognized as such in the catalogues. It is evidently carried about by commerce, specimens in the British Museum having been found in rice and wheat in India.

The descriptions of *Trogoderma (Eurhopalus) rubiginosus* and *variegatus* of Solier (Gay's 'Historia di Chile,' iv. p. 373) are transposed, as comparison with the figures shows.

T. variipes, Blackb. (T. R. Soc. S. Austr. xii. 1892, p. 208), is omitted from the catalogue. The name *variipes*, Casey, is a duplicate, and that of

Trogoderma caseyi (nom. nov.)

may be substituted for it.

Trogoderma consors, sp. n.

Ætrum, antennis pedibus elytrorumque apicibus rufescentibus, elongato-ovale, undique æqualiter griseo-pubescent, pronoto fortiter annulato-punctato, subnitido, basi medio breviter et late lobato, utrinque oblique sulcato; scutello sat magno; elytris dense granuloso-rugosis, apicibus separatim rotundatis, antennarum clava 5-articulata, serrata.

Long. 3-3.5 mm.

Hab. N.W. AUSTRALIA: Bathurst I.

The extremities of the elytra are separately rounded, as in *T. occidentale*, Blackb., but it is more elongate, less densely granulated and opaque, the pronotum less pointed behind, and the visible scutellum larger. It more resembles *T. eyrense*, Blackb., but the apices of the elytra are not rounded in that species and the club of the antenna is narrower. The oblique grooves extending from each side of the base of the pronotum are scarcely visible in either of Blackburn's species.

Trogoderma pectinifer, sp. n.

Nigrum, opacum, undique griseo-setosum, pedibus, elytrorum apicibus, antennisque rufis; ovatum, modice convexum, capite pronotoque densissime punctato-rugosis, hoc valde convexo, lateribus

regulariter arcuatis, paulo explanatis, basi fortiter et angulatim lobato; elytris grosse et crebre granulatis, apice separatim rotundatis; antennis (♂) longe pectinatis.

Long. 4.5 mm.

Hab. NEW S. WALES: Baan Baa (*G. E. Bryant*, Oct. 1908).

A unique example presented to the Museum by Mr. Bryant.

As in the species last described, the elytra are rounded at the end and do not quite cover the abdomen, but they are more uniformly granulated and opaque, and only the extremities are red. The pronotum also is much more densely sculptured than in *T. consors*, and its posterior lobe is more pointed. The antennæ of the male (the female is unknown) are strongly pectinated, the basal joint alone being bead-like and black, the succeeding joints red and more or less produced, and the terminal one flat and oval.

Trogoderma frater, sp. n.

Nigrum, sat nitidum, tarsis antennarumque stipite rufis; ovatum, parum convexum, erecte setosum, pronoti medio minutissime punctulato, nitidissimo, lateribus punctato-rugosis, elytris fortiter punctatis et rugulosis, haud abbreviatis; antennarum clava (♂) serrata, sex-articulata.

Long. 3.5 mm.

Hab. NEW S. WALES: Illawarra (*G. E. Bryant*); Victoria (*Edwards*).

This is closely similar to *T. difficile*, Blackb., but the pronotum is much more finely and scantily punctured in the middle, and the posterior lobe is broader and more regularly rounded. The antennæ are quite different to those of Blackburn's type, but the latter is probably a female, not a male as Blackburn believed. In *T. frater* the first two joints are globular and dark-coloured, the next three very small, short, and red, the sixth red and a little produced anteriorly, the remaining five large and dark, the seventh to tenth strongly produced. The whole upper surface of the body is clothed with stiff setæ and rather rugulose except in the middle of the pronotum, which is very shining. Blackburn has described the setæ as black and grey in *T. difficile*, but I believe this is an illusion, the apparent colour changing according to the incidence of the light.

Trogoderma tricolor, sp. n.

Ovale, parum elongatum, nigrum, vix nitidum, elytrorum apicibus læte rufis; crebre punctatum, minute griseo-setosum, pronoti lateribus et lobo postico elytrorumque fasciis tribus, plerumque late interruptis, albo-squamosis, pedibus antennisque rufis, illis longis, his sat brevibus, clava triarticulata, ovali, articulis duobus penultimis brevissimis.

Long. 3 mm.

Hab. ARABIA: Yemen (*Millingen*).

This interesting species is very different from any other known to me. The white spots are composed of long pointed scales, not fitted together edge to edge as in *Anthrenus*, but free at the end and massed in thick loose clusters. The legs are long and not capable of being closely folded up as in that genus, and although there are cavities in the episterna for the reception of the antennæ they are not very sharply defined and coincident with the antennæ. The club of the latter is broadly oval and flat, consisting of three transverse joints, the last of which is not quite twice as long as the other two, which are very short. In a series of seven specimens, which I believe to include both sexes, I can see no perceptible difference in the antennæ.

Trogoderma eximium, sp. n.

Oblongo-ovale, nigrum, sat crebre et æqualiter (elytris paulo fortius) punctatum, ubique griseo-pubescent, vix nitidum, elytris macula post-humerali aliaque apicali utrinque ornatis; corpore supra etiam maculis 11 albo-setosis (pronoti duabus lateralibus unaque basali, elytrorum 4 antemedianis et 4 postmedianis transversim positis); pedibus antennarumque stipite rufis, harum clava (♂) elongata, 3-articulata, articulo ultimo ad duos præcedentes longitudine fere æquali.

Long. 3 mm.

Hab. RHODESIA: Salisbury, Umtali.

Three specimens were taken by Mr. G. A. K. Marshall and presented by him to the British Museum.

The species resembles *T. tricolor*, but it is larger and more oblong in shape, and the white spots, of which there are only two ranges instead of three upon the elytra, are formed of fine hairs, and not of scales. There are also two conspicuous red patches upon each elytron, the first transverse and placed behind the shoulder, the other nearly round and occupying

the apical angle, not quite reaching the margins. The antenna is short, but the club is relatively large (about two and a half times as long as it is wide), with the first two joints transverse and the last rather longer than it is wide. The legs are slender and the front tibiæ very spinose externally.

Trogoderma rufopictum, sp. n.

Oblongo-ovale, nigrum, æqualiter haud dense punctatum et sat longe brunneo-setosum, paulo nitidum, elytris macula humerali obliqua, ab marginem externam fere ad suturam extensa aliaque anteapicali integra fere recta ornatis, abdomine, pedibus antennisque rufis, his longis, gracilibus, clava 5-articulata, monilata, articulo ultimo quam præcedenti duplo longiori.

Long. 3 mm.

Hab. NATAL: Frere.

Three specimens found in flowers by Mr. G. A. K. Marshall have been presented by him to the British Museum.

T. rufopictum is similar in size, shape, and general appearance to *T. eximium*, but is without the pattern formed of clustered white hairs. The clothing is uniform, rather long, but not close. The hairs are reddish upon the red elytral patches and darker elsewhere. The antennæ are very different from those of the preceding species, being entirely red, slender, and loosely articulated. The joints composing the club are of a different texture to the rest, but little differentiated in size, although gradually enlarging towards the extremity.

Trogoderma nitens, sp. n.

Nigrum, elytris pone humeros late et recte rufo-fasciatis, fascia ad suturam breviter interrupta, apicibusque rufis; sat late ovale, supra nitidum, sparsim erecte setosum, capite grosse et rugose punctato, pronoto parce, lateribus autem crebre et rugose, punctato, postice haud fortiter lobato, utrinque profunde oblique impresso; elytris undique parce punctatis; antennarum clava 6-articulata, paulo serrata, parte basali et tarsis rufis.

Long. 3 mm.

Hab. S. BRAZIL: Sta. Catharina.

This appears to have the same coloration as *T. pectinicornis*, Reitt., but it is smaller and, instead of being densely punctured, is unusually smooth and shining, with only a very scanty sprinkling of punctures and fine setæ upon the pronotum and elytra. It is oval, not long, and black, with a large bright orange-red patch behind each shoulder, reaching

the lateral margin but not quite extending to the suture, and another nearly round terminal patch leaving only the extreme apex black.

Genus PSACUS.

This genus, formed by Pascoe for an Australian insect and placed by him in the Rhipiceridæ, in reality belongs to the Dermestidæ, being a highly developed form related to *Trogoderma*. The antennæ, in the male especially, have attained an extraordinary development, and the sides of the prothorax in that sex are much dilated, to form a large cavity beneath for the reception of the great fan-like club. This and the large size of the female give the two sexes a strikingly different aspect. The possession of a frontal ocellus, overlooked by Pascoe, and many other features leave no doubt as to the true affinities of the insect. *Trogoderma serviger*, Sharp, from New Zealand, is a nearly related species.

Genus CTESIAS.

The name *Tiresias* was substituted for *Ctesias* by Newman, on the ground that the latter name had been previously used by Hübner; but Hübner's genus is *Chesias*, so that *Tiresias* is redundant.

The South-African species here described has little superficial resemblance to the only hitherto known species, *C. serra*, F., but the form of the antenna, the only really distinctive feature of the genus, is practically identical, and, as there seems to be no structural difference of any importance, I put the two insects together. If, as is possible, the identity in the structure of the antennæ is only the result of parallel development, then the genus *Ctesias* ceases to have any justification, and both insects must be regarded as only aberrant species of *Trogoderma*.

Ctesias variegata, sp. n.

Nigra, elytris hic illic obscure rufo-variegatis, corpore subtus ubique, supra maculatum, albido-setoso; late ovata, crebre punctata, oculis magnis, prope antennis profunde emarginatis, pronoto lato, postice fortiter lobato, lobo rotundato; elytrorum apicibus separatim rotundatis; antennis tarsisque rufis, harum clava magna, 3-articulata, articulis antice valde lobatis, funiculo brevissimo.

Long. 3.5 mm.

Hab. RHODESIA: Salisbury.

A single male specimen was found by Mr. G. A. K. Marshall.

It is broadly oval, strongly punctured, opaque, and pubescent. Its upper surface is sprinkled with white spots, formed of clusters of white decumbent setæ, situated at the margins of the pronotum, upon the posterior lobe, the basal margin of the elytra, three other transverse ranges, and the apical angles. The antenna of the male scarcely differs from that of *C. serra*, except that the last joint is more deeply emarginate at the end, becoming slightly bilobed.

Genus THAUMAGLOSSA.

Anthrenus ovalis, Fleut., is evidently the common *Thaumaglossa rufocapillata*, Redt.

Thaumaglossa rufocincta, sp. n.

Nigra, antennis, pedibus, abdomine, fasciæque elytrorum lata, medio nonnunquam interrupta, extus dilatata et ad humeros producta, rufis; corpore supra et subtus sat æqualiter pubescenti, capitis et prothoracis pilis flavis, fasciæ rufescentibus; pronoto haud lato, subtiliter sat parce punctato, elytris fortius et densius.

Long. 3-4 mm.

Hab. RHODESIA: Salisbury.

Both sexes were taken by Mr. G. A. K. Marshall, by whom they have been presented to the British Museum. They were found flying in the sun and also beaten out of a tree (*Zizyphus*).

It is a very distinct species, with a transverse red band upon the elytra, such as reappears so frequently in the different genera of Dermestidæ. This band broadens from the suture to the sides, where it reaches the shoulders, the front margin being oblique, while the hind margin is almost straight. The upper surface of the body is less closely punctured than it is in the common *T. rufocapillata*, and the shape is less broad. The large terminal joint of the antenna of the male is shorter, being little longer from base to apex than its width at the base, and the eight joints forming the foot stalk are very short, the last four gradually dilating to the point of attachment beneath the club. In the female the last joint is nearly spherical, the three preceding ones progressively enlarged, and the penultimate rather rectangular.

Thaumaglossa oothecobia, sp. n.

Nigra, pygidio, vel abdomine toto, antennis, tarsis elytrorumque

fascia transversa, extus haud vel parum dilatata, horum apicibus etiam nonnunquam, rufis; capite, pronoto elytrorumque basi sat longe et dense griseo-setosis.

Long. 2.5-3 mm.

Hab. S. NIGERIA: Ibadan.

About fifty specimens of this insect, now distributed between the British Museum and the Hope Collection at Oxford, were bred by Dr. W. A. Lamborn from the egg-cluster of a *Mantis*, emerging from it at various dates in July 1913.

It greatly resembles *T. rufocincta*, but is a little smaller, with relatively wider prothorax, rather more abruptly truncated scutellum and distinctly shorter elytra. The median red band does not noticeably dilate towards the sides, but is of approximately equal width throughout. The longer and paler hairs of the head and pronotum extend also to the base of the elytra, where they form a conspicuous transverse band. In a few specimens more or less large red patches occur upon the apices of the elytra, and these may even become united with the median band. The club of the antenna of the male is practically the same as in *T. rufocincta*.

Thaumaglossa lata, sp. n.

Nigra, antennis, pedibus, abdomine, elytrorumque fascia lata transversa, rufis; corpore supra et subtus sat æqualiter pubescenti, capitis et prothoracis capillis flavis, fasciæ rufescentibus; pronoto haud lato, cum elytris fortiter confertim punctatis, lateribus densius, lobo postico valido, truncato.

Long. 3 mm.

Hab. S. CHINA: Hongkong.

A single specimen was taken by Commander J. J. Walker in 1892. It is a female, with the circular terminal joint of the antenna larger than in the same sex of either of the two preceding species. The coloration is the same, but the median red band is narrowed at the outer edge. The elytra are strongly and closely punctured, the disc of the pronotum strongly but less closely, and the sides very densely. The posterior lobe is broadly truncated at the end.

Thaumaglossa sex-maculata, sp. n.

Nigra, antennis, pedibusque flavidis, maculisque elytrorum sex læte flavis, subæqualibus, duo utrinque ante medium transverse positissimæ unaque post medium; late ovata, sat dense pallido-pubescenti, pronoto minute sat crebre, elytris fere rugose punctatis, his postice separatim rotundatis; antennarum articulo ultimo (maris) magno, brevissime cordiformi.

Long. 2 mm.

Hab. RHODESIA : Umtali.

A single male was found by Mr. G. A. K. Marshall in October 1897.

It is a minute species, showing an approximation to the genus *Orphinus*. It is rather broadly oval, with close, nearly erect pubescence. Each elytron has three large bright yellow spots, one at the outer edge behind the shoulder, one transversely in line with it near the suture, and the third exactly in line with the second towards the apex. The last joint of the antenna (in the male) is extremely short and very feebly pointed at the end.

Thaumaglossa ovalis, sp. n.

Nigra, antennis, pedibus abdomineque pallide flavis; sat dense griseo-hirta, elytrorum fascia antica, intra-humerali, maculaque utrinque rotundata, postica, fere denudatis; corpore regulariter ovato, convexo, sat nitido, subtiliter punctato, elytris haud abbreviatis, postice attenuatis, abdomen toto obtegentibus.

Long. 2·5 mm.

Hab. CHINA (*J. Bowring*).

This species differs entirely from all the others in its regularly oval convex shape and tapering elytra, which completely cover the abdomen. It is lightly punctured and rather shining, with grey pubescence, which leaves bare a transverse strip at the shoulders and a round posterior patch on each elytron. The terminal joint of the antenna in the male is about three times as long as its greatest width.

Thaumaglossa nitidula, sp. n.

Rufobrunnea, paulo nitida, setis oblique erectis, flavidis et fuscis, subseriatim ordinatis, sat parce vestita; late ovalis, ubique minute haud dense punctata; pronoto lato, postice lobato et truncato; elytris haud abbreviatis, apicibus minute rotundatis.

Long. 2·5 mm.

Hab. MALAY PENINSULA : Perak. SIAM : Renong.

A male specimen was found in each of the above-mentioned localities by Doherty.

No other species of the genus can be compared with this, which is peculiar in its lightly punctured shining surface and the uniformly scattered erect setæ upon its upper surface. It is small and rather broadly oval in shape and red-brown in colour. The posterior lobe of the pronotum is truncated, and the extremities of the elytra are very minutely rounded and practically cover the abdomen. The terminal joint of the

antenna of the male is short and heart-shaped, a little more pointed than in *T. rufocincta* and *oothecobia*, but less so than in *T. rufocapillata* and *hilleri*.

Genus ORPHINUS.

The genus *Orphinus* of Motschulsky, quite wrongly placed with *Orphilus* in Dalla Torre's Catalogue, is really a large and important one, of which a number of species have been described under the name of *Cryptorrhopalum*, while many more remain undescribed. Reitter has stated that the typical species, *O. hæmorrhoidalis*, Motsch., belongs to *Cryptorrhopalum*, and has changed its name to *C. motschulskyi*; but in 1908 (Bull. Soc. Ent. Egypte, i. p. 45) he described a so-called new genus (*Æthriosia*), the characters of which are precisely those of *Orphinus*. He placed in it only a single species (*globulicornis*) from Egypt, and omitted to note that many others, including several previously described by himself, are congeneric with it. As already stated by Sharp (Biol. Centr.-Amer., Coleopt. ii. 1, p. 652), *Cryptorrhopalum* is really a well-marked American genus, and the various Oriental and Australian insects which have been referred to it have none of them its essential feature, viz., an antennal club composed of two large, nearly equal joints. The chief diagnostic character of *Orphinus*, as given by Motschulsky, is a "club composed of two very unequal joints, the last circular." The statement that the antenna is 9-jointed is probably due to Motschulsky wrongly counting the minute joints preceding the club, as the number is eleven in the species known to me. The last joint is flat and circular, very large in the male, with the preceding joint relatively small and connate with it. In the female the penultimate joint is larger and the last smaller. In some, if not all, of the species the last ventral segment is broadly depressed in the male and the hind margin produced into a sharp spine on each side of the depression. The mesosternum is broad and completely divided by a channel, which receives the spinose prosternal process.

Sharp and Blackburn did not know the genus *Orphinus*, or they would certainly have placed in it the Old-World insects they have provisionally called *Cryptorrhopalum*. Until other genera are created, it will probably be most natural to transfer to it all the non-American insects now unnaturally associated with *Cryptorrhopalum*. The following may be regarded as typical species of *Orphinus*:—*O. hæmorrhoidalis* and *pedestris*, Motsch., *Trogoderma defectum*, Walker,

Æthriosia globulicornis, Reitt., and *Cryptorrhopalum affine*, Reitt., *biflexum*, Reitt., *terminale*, Sharp, *brevicorne*, Sharp, *australicum*, Blackb., *quornense*, Blackb., and *woodvillense*, Blackb. A comparison of Blackburn's types and a series of other specimens has led me to the conclusion that *Cryptorrhopalum eucalypti*, Blackb., is only a rather pale specimen of the last species, *Orphinus woodvillensis*.

A few new species are added here :—

Orphinus æthiops, sp. n.

Niger, antennis pedibusque flavis, ubique parce punctatus et pallide pubescens, punctis minutis; ovatus, parum convexus, oculis magnis, grosse granulatis, antennarum articulo ultimo (maris) magno, discoidali; pronoto lato, brevi, lateraliter bene marginato, postice valde et late lobato; elytrorum apicibus minute rotundatis.

Long. 2·3 mm.

Hab. ANGOLA: Forest Country, 1000–2000 ft. alt. (Dr. Welwitsch). MAURITIUS (*J. E. M. Brown*).

There are two specimens in our collection from Angola and a good series from Mauritius. Unless in one case they have been accidentally introduced, the species must be supposed to have a very wide distribution.

It is uniformly black, with pale legs and antennæ and a thin and evenly distributed clothing of greyish hairs above and beneath. The upper surface is rather shining, the punctures being minute and scattered. The eyes are large, prominent, and coarsely faceted, and separated by a distance less than twice their diameter. The pronotum is short, little narrowed in front, and sharply margined at the sides, with a strong, broadly rounded, posterior lobe. The last joint of the antenna of the male is flat, circular, and very large.

Orphinus japonicus, sp. n.

Niger, sat nitidus, parce griseo-setosus, macula rufa utrinque obliqua post humeros sita, antennis pedibusque late rufis; ovatus, modice convexus, capite pronotoque lævibus, parum setosis, hujus marginibus lateralibus prominentibus paulo explanatis, lobo postico late rotundato, utrinque oblique impresso; elytris crebre punctatis, breviter æqualiter setosis.

Long. 2·5 mm.

Hab. JAPAN: Fukushima, Shinkano (*G. Lewis*, July 1881);

Mimasaka (*J. E. A. Lewis*, July 1913). The Museum contains a specimen from each locality, two of them males.

It is black and shining, with the legs and antennæ yellow, and a bright red oblique patch upon each elytron behind the shoulder. It is rather broadly oval in shape, the pronotum rather smooth and shining, broadly lobed behind, with the lateral margins, especially in the male, slightly flattened and the elytra finely and closely punctured, with fine and even, but not close, pubescence. The last joint of the antenna of the male is very large and circular, that of the female similar but less than half the diameter.

Orphinus jucundus, sp. n.

Niger, profunde, modice crebre, punctatus, sat longe et æqualiter flavo-pubescent, antennis pedibusque rufescentibus, subnitidis, elytrorum macula transversa antemediana, ad suturam vix attingenti, apicibusque læte rufis; oblongo-ovalis, prothorace transverso, lobo brevi, lato, rotundato.

Long. 2-2.75 mm.

Hab. BOMBAY: Belgaum.

A series was collected by Mr. H. E. Andrewes, who found large quantities by sweeping grass just after the rains (November and December). It was also found in March and April. The species was also taken in Bombay many years ago by the late Dr. Leith. It occurred in Belgaum in company with *O. biflexus*, Reitt. It is larger, more oblong, and less convex than that species, the thoracic lobe is shorter and less pointed, the punctures of the pronotum and elytra larger and more distinct, and the pubescence of the former darker. The anterior red band of the elytra is interrupted at the suture and not continuous as in *O. biflexus*. The terminal joint of the antenna of the male is very large and nearly circular, but slightly pointed at the end, and the penultimate joint is small. The last ventral segment in the same sex is broadly depressed and the hind margin bears a sharp spine on each side of the depression.

Orphinus nilgirensis, sp. n.

Niger, ovatus, valde convexus, fortiter punctatus, breviter flavo-pubescent, pronoti lateribus, elytrorum fascia transversa antemediana recta parteque tertia apicali longius et densius pubescentibus, his partibus nonnunquam rufis, pronoto antice valde arcuato, postice lobo brevi, lato, rotundato prædito.

Long. 2-2.5 mm.

Hab. S. INDIA: Nilgiri Hills.

Numerous specimens of this were taken by Mr. H. L. Andrewes by sweeping in the Auchterlony Valley (3500–5000 ft.) in December, also by beating round small patches of jungle in hollows of open downs at Naduvatum (6000–6500 ft.). It is very like *O. jucundus*, but smaller, more oval, and more convex. The pattern and arrangement of the pubescence are the same, but the hairs are shorter and less uniform and lie closer together, the posthumeral band and apical patch of light hairs are more sharply defined, and the hairs occupying the remaining surface of the elytra much shorter and darker. The antennæ are light red, the last joint very large, flat, and completely circular in the male, and the preceding joint very small. In the female the penultimate joint is nearly half the diameter of the last. The last visible (fifth) ventral segment of the male is broadly depressed, and the hind margin armed with a spine on each side of the depression.

Orphinus minor, sp. n.

Fusco-niger, antennis pedibusque rufescentibus; ovatus, convexus, griseo-pubescent, supra undique profunde sat grosse et crebre punctatus, pronoti lobo postico brevi, rotundato.

Long. 2 mm.

Hab. BOMBAY: Belgaum.

A number of specimens were taken by Mr. H. E. Andrewes, by whom it has been presented to the British Museum, together with the two preceding species. It was found in company with *O. jucundus* in sweeping grass at the end of the rains (November and December), but not nearly so plentifully as the other species.

It is like *O. affinis*, Reitt., without spots or bands of pigment or pubescence, and also without the reddish extremities of the elytra of that species. It is also smaller, less elongate, and more convex, with the prothorax relatively much longer and more rounded in front. The posterior lobe is shorter and more broadly rounded. The puncturation and clothing are almost exactly as in *O. affinis*.

Orphinus tabitha, sp. n.

Totus niger, sat nitidus, tarsi antennisque solum piceis; breviter ovatus, valde convexus, haud longe griseo-pubescent, prothoracis lateribus, fasciis elytrorum tribus transversis suturaque anguste pilis longioribus et densioribus ornatis, fascia prima basali, secunda antemediana tertiaque anteapicali, corpore supra profunde sat crebre punctato, pronoto postice valde lobato.

Long. 2.5–3 mm.

Hab. CEYLON: Kandy, Dikoya, 3800–4200 ft. (December 1881 to February 1882).

Five specimens collected by Mr. George Lewis seem to be all males. The terminal joint of the antenna is slightly ovate and not very large. The last visible (fifth) ventral segment has on each side of its posterior margin two sharp spines placed not far apart.

It is a black species, with the sides of the pronotum clothed with long and close grey hair, and three transverse nearly straight bands of similar hairs common to both elytra—the first band at the base, the second before and the third behind the middle. The middle band is nearer to the first than the third. The legs are black and the tarsi and antennæ alone red.

Orphinus funestus, sp. n.

Niger, antennis tarsisque flavidis; convexus, sat late ovatus, dorso subtiliter, extus crebre et rugose, punctulatus, undique haud dense griseo-setosus; pronoti lobo postico valido sat angusto.

Long. 2 mm.

Hab. CEYLON: Dikoya, 3800–4200 ft. (Dec. 1881, Jan. 1882).

Two specimens were found by Mr. G. Lewis, one of each sex.

This is another small black species, with a close general resemblance to *O. aethiops*. It is more convex and globular, finely but more closely and rugosely punctured. The lobe of the pronotum is stronger, rather narrow, and more rounded at the end. The antennæ are longer and the terminal joint of the male is smaller, but completely round. That of the female differs only in size.

Orphinus minimus, sp. n.

Niger, nitidus, subtiliter haud dense griseo-setosus, pronoto elytrorumque fasciis tribus integris fere rectis (prima marginali) capillis albidis longioribus sat sparsis ornatis, tarsis antennisque flavescens; parvus, ovatus, valde convexus, pronoto postice fortiter lobato, lobo fere truncato.

Long. 1.5 mm.

Hab. N.W. AUSTRALIA: Roebuck Bay, Baudin Point, Parry I., Baudin I.

One specimen was taken in each locality by Commander J. J. Walker.

It is a very small species resembling *O. quornensis*, Blackb., *Ann. & Mag. N. Hist.* Ser. 8. Vol. xv. 30

but smaller, more regularly ovate, much more sparingly punctured and shining. The clothing is also much less close and the three transverse elytral bands are nearly straight and less defined, being composed of rather long but not numerous white hairs.

Genus HYPOCEUTHES.

This genus was formed by Gerstaecker for a single African species (*H. aterrimus*), but no generic characters of any value are attributed to it. It may be a denuded *Anthrenus* or possibly an *Orphinus*.

Genus CRYPTORRHOPALUM.

C. 7-signatum, Sharp, was figured (but apparently not described) by Lacordaire as *C. flavopictum* (Genera Col., Atlas, pl. xxiii. fig. 1).

The following species of the genus I believe to be new:—

Cryptorrhopalum eximium, sp. n.

Nigrum, pedibus fusco-rufis, ubique minute punctatum et sericeo-hirtum, capite pronotoque nitidis, elytris dense punctatis et vestitis, opacis, singulo maculis duobus magnis, flavis, rotundis ornato; breviter ovatum, parum convexum, clava antennali sat magna, brevi, rufa, articulis subæqualibus.

Long. 3 mm.

Hab. BRAZIL: Para.

A single specimen in the British Museum (from the Fry collection) was found by Mr. H. H. Smith.

It is a beautifully marked species, black, with a large round yellow patch at the base of each elytron, just reaching the anterior margin, and another of the same size and shape near the extremity, but not reaching the margins. The head and pronotum are shining, very finely but not closely punctured and pubescent, and the elytra are very densely punctured and clothed and entirely opaque.

Cryptorrhopalum felis, sp. n.

Fuscum, griseo-vestitum, pedibus rufis; ovale, subglobosum, undique crebre punctatum et sat longe capillatum, pronoto, elytrorumque basi, medio et apicibus capillis longioribus et densioribus vestitis, pronoti lobo postico truncato, bipenicillato, clava antennali sub-orbiculari, articulo ultimo quam primo paulo minori.

Long. 2-3 mm.

Hab. S. BRAZIL: Rio de Janeiro (*A. Fry*), Bahia (*Reed*).

This is a very convex, subglobular insect, densely sculptured and clothed above with rather long and coarse ashy-grey hair. The clothing is long and shaggy upon the pronotum, and its posterior lobe, which is truncated, has two backward-pointing brushes or tufts. Upon the elytra the hairs are longer and closer at the front margin, the apex, and the middle. At the latter part they form a transverse bar, widest at the suture, and tapering at each end without reaching the sides.

Cryptorrhopalum scutellare, sp. n.

Rufum, æqualiter minute punctatum et flavo-sericeum; parvum, breviter ovatum, convexum, pronoti lobo postico valido, recte truncato; scutello nudo, nitido, impunctato; antennarum clava brevi, articulis duobus fere æqualibus.

Long. 2 mm.

Hab. W. INDIES: Mustique I. (Grenadines).

Two specimens were obtained by Mr. H. H. Smith.

A minute insect, regularly oval in shape and very convex, closely and uniformly clothed with minute decumbent greyish or yellowish-grey silky hairs, but with the scutellum free from hair and punctures and very shining. The posterior lobe of the pronotum is squarely truncated, and is also smooth and shining at its extremity, and the hairs at its base are divided, so as to present the appearance of two tufts.

ANTHRENO CERUS, gen. nov.

Corpus compactum, setosum, haud squamosum. Pedes graciles. Prosternum antice productum ad capitis receptationem, postice angustum, mesosternum toto bisectans, lateraliter profunde excavatum ad antennarum receptationem. Antennæ crassæ, stipite brevi, articulis valde transversis, compactis, clava 3-articulata, magna, cylindrica, articulo primo et tertio longitudine fere ad latitudinem æquali, secundo transverso.

Type, *Anthrenus australis*, Hope.

This genus is intermediate between *Trogoderma* and *Anthrenus*, the antennæ being of the short massive type characterizing the latter, and the large, compact, three-jointed club exactly fitting a deep sharply defined cavity provided for it in the anterior half of the side of the prosternum. All the joints fit very closely together, the foot-stalk is short, the club long, abrupt, and of nearly equal width throughout. The head fits closely against the prosternal plate, but is less deeply sunk in the prothorax than in *Anthrenus* in the

position of rest, and the anterior legs are not closely fitted together. The clothing consists of short setæ and not broad scales.

So far as is known, the genus is confined to Australia. It includes the five species grouped by Blackburn (Trans. Roy. Soc. S. Austr. xxvii. 1903, p. 169) as "aberrant *Cryptorhopala*" (*C. australe*, Hope, *confertum*, Reitt., *variabile*, Reitt., *quadrifasciatum*, Blackb., and *terzonatum*, Blackb.). The first, of which I have examined the type in the Oxford Museum, I believe to be the species later described as *Trogoderma riguum*, Er. Two other species are added here:—

Anthrenocerus bicolor, sp. n.

Niger, elytris pedibusque ferrugineis, corpore supra fulvo-pubescenti, setis longioribus albidis variegato, subtus minute sat crebre albo-vestito; ovatus, pronoto brevi, subnitido, postice fortiter lobato, lobo dense, marginibus anticis et lateralibus minus dense albo-setosis; elytris crebre punctatis, irregulariter quadrifasciatis, fascia prima marginali, apicibusque albo-setosis.

Long. 2.5 mm.

Hab. N.W. AUSTRALIA: Adelaide R., Roebuck Bay (*J. J. Walker*).

This has a close similarity to *A. australis*, Hope, but is easily distinguished by its reddish elytra, in addition to which the bands of white hairs are more irregular.

Anthrenocerus pulchellus, sp. n.

Ferrugineus, setis decumbentibus brevibus flavis et albis intermixtis variegatus, corpore subtus nigro, subtiliter sat crebre albo-vestito; anguste ovatus, convexus, prothorace antrorsum valde angustato, postice fortiter lobato, lobo partibusque anticis et lateralibus griseo-setosis; elytris irregulariter trifasciatis, fascia antice ad suturam late interrupta, ad basin producta, apicibus etiam setosis.

Long. 2 mm.

Hab. N.W. AUSTRALIA: Baudin Point, Baudin I.

This, as well as the last species, was taken by Commander J. J. Walker. It is a smaller and narrower insect than *A. bicolor*, and the clothing of the upper surface consists of shorter and more close-lying, rather scaly hairs, yellow and white mixed, disposed as in *A. bicolor*, but in rather larger and better-defined patches.

Genus ANTHRENUS.

Anthrenus varius, F., was described in Ent. Syst. i. p. 264. The reference given in both Gemminger and Harold's and Dalla Torre's Catalogues (Syst. Ent. p. 60) is to *Byrrhus varius*, F., an entirely different insect, now known as *Cytilus sericeus*, Forst.

A. vorax, Wat., is synonymous with *A. fasciatus*, Herbst, which has a very wide range.

A. lepidus, Lec., and *occidens*, Casey, seem to me to be varieties of the protean and almost universal species *A. pimplinellæ*, F.

Reiter's type of *A. subclaviger* is apparently the female. Besides specimens from his locality (Aden), we have specimens from Calcutta (taken in the Museum compound). The species has been sent also from the N.W. Himalayas (taken in flowers of *Castanea vesca*) and the Punjab. In the males the antennæ are longer than in the females and the club consists of two joints only instead of three.

Anthrenus (subgen. *Florilinus*) *sinensis*, sp. n.

Brunneus, squamis breviter triangularibus vestitus, ventralibus griseis, dorsalibus brunneis et griseis, pronoti basi ab his toto tecto, elytrorum fasciis duabus fere rectis maculaque apicali, antennis 7-articulatis, clava solida, gracili, maris quam articulis præcedentibus multo longiori.

Long. 2.5-3 mm.

Hab. N. CHINA : Tientsin (*F. M. Thomson*).

A long series of specimens received from Mr. Thomson show constant differences from *A. musæorum*, L., to which it is exceedingly close. It is rather narrower in shape and the average size is a little smaller. The scales are of the same short triangular form, but a little longer in *A. sinensis*, and those forming the background are not black but a dull brown. The pale patches of scales at the sides of the pronotum, which are separated in *A. musæorum* by a well-marked interval, unite in *A. siamensis* upon the basal lobe, and the fasciæ of the elytra are less irregular in outline. The antenna consists of seven joints, the first two globular, followed in the male by four equal minute transverse joints and a slender fusiform solid club considerably longer than all the rest together; in the female, by two small but slightly elongate joints, two progressively longer, dilating towards the extremity, and a club-joint about as long as the three preceding ones together.

Anthrenus subsetosus, sp. n.

Brunneus, corpore subtus nigro, pedibus antennisque rufis, subtus griseo-, supra flavo-squamoso, hic squamis rufis et fuscis variegato, squamis longissimis; pronoti angulis posticis, lobo postico annulaque discali pallido-squamosis, squamis reliquis obscuris; elytrorum fascia communi post-humerali annulaque subapicali utrinque pallide squamosis; corpore late ovato, prothorace haud lato, antice paulo producto; antennis 11-articulatis, clava 3-articulata. Long. 3 mm.

Hab. UPPER BURMA (Gray).

This closely resembles *A. verbasci*, L., but is rather more elongate and has much longer and narrower scales, those upon the pronotum being scarcely distinguishable from hairs. The lower surface is black, not very densely clothed with fine white setæ, and the upper surface brown, with its scales varying from pale yellow to dark brown, but with every gradation, the pattern resulting being therefore without strong contrasts. The scales, moreover, are not closely fitted together and immovable, but form a rather loose shaggy clothing.

A series of specimens were received by Mr. H. E. Andrewes, by whom several have been presented to the British Museum.

Anthrenus seminulum, sp. n.

Globosus, brevissimus, fuscus, squamis magnis latis dense vestitus, inferis albidis, superis fulvis albidis et brunneis, elytrorum macula magna subrotundata, postica fusca, a medio fere ad apicem extensa; antennis brevissimis, 11-articulatis, clava 3-articulata, breviter pyriformi, articulo ultimo maximo. Long. 2.5 mm.

Hab. S. RHODESIA: Salisbury.

Two specimens of this very distinct species were found by Mr. G. A. K. Marshall in August 1900. I believe them to be male and female, the antennal club of one being slightly larger than that of the other. It is a very short, broad, and globular insect, covered with large nearly round scales, which are whitish beneath the body and at the sides of the pronotum, various shades of yellow and brown intermixed upon the general surface, with a large nearly round patch of dark brown scales upon the posterior half of the elytra. The pronotum is short, evenly convex, and furnished with a strong, pointed, triangular lobe behind, entirely covering the scutellum. The elytra are slightly flattened upon the dark

posterior area, and each has a rather sharp prominence just before the apex. The antennæ are exceedingly short and closely articulated, with a three-jointed pear-shaped club, of which the first joint is small, the second rather large, and the last very large, forming more than half the club.

Anthrenus globiger, sp. n.

Rotundus, toto niger, dense punctatus et squamosus, squamis inferis albis, superis nigris, pronoti lateribus, maculisque elytrorum punctiformibus 13 circiter albis; antennis brevissimis, 8-articulatis, articulo ultimo magno, hemisphærico.

Long. 2.5 mm.

Hab. INDIA : Calcutta.

Two specimens in the British Museum formed part of the Bowring Collection. One of them is labelled "India" and the other (perhaps wrongly) "China." A specimen in the Calcutta Museum was found by Mr. F. H. Gravely upon the Museum premises.

The sharply defined black and white scaling is very distinctive, and, judging from the identical aspect of the three specimens before me (taken at an interval of more than half a century), the species is not subject to the extreme variability prevailing in other *Anthreni*.

The sides of the pronotum are broadly white, the white scales extending a short distance round the base. Upon the black median area there is a central white spot, two upon the posterior lobe, and several at the front margin. Upon the elytra there is a common white spot just behind the thoracic lobe, and upon each a small anterior spot near the lobe, one behind the shoulder, two at the outer margin behind the middle, and two near the sutural margin behind the middle. The antennæ are very short, consisting of eight joints, all but the terminal one transverse, and this circular in shape, with its diameter not quite as long as the foot-stalk, and hemispherical in shape, with its convex face beneath and the flat upper surface alone exposed in the retracted position.

Anthrenus megalops, sp. n.

Elongatus, flavus, nitidus, squamis breviter triangularibus brunneis, fulvis et albis tectus, pronoti lateribus elytrorumque plagis vagis tribus albis, prima antemediana, aliis postmedianis, antennis 9-articulatis, clava biarticulata, articulo ultimo quam tribus præcedentibus paulo longiori.

Long. 3.5 mm.

Hab. ABYSSINIA (*A. Raffray*).

This and the following species are of an elongate form quite peculiar in the genus, the length of the elytra being twice their conjoint width. *A. megalops* is yellow in colour and clothed with short, moderately large scales, abruptly truncated at their free end. They are chiefly buff-coloured, with three ill-defined transverse patches of white scales, the first before the middle and widely separated from the other two, which are considerably behind the middle. Amongst the lighter scales, and especially between the two posterior white bands and before the apex, there are scales of a dark brown colour. The antenna is composed of nine joints, the first two globular, the third similar but minute, the fourth and fifth slightly elongate, the sixth like the third, the seventh larger, short, and flattened, the eighth transverse and closely articulated to the terminal joint, which is rather longer than the three preceding together.

Anthrenus longus, sp. n.

Rufo-brunneus, supra opacus, elongatus, dense punctatus, squamis breviter ovatis, magnis sat dense tectus, squamis plerumque brunneis sed pronoti lateribus, elytrorum macula angulata post-scutellari, fascia transversa postmediana apicibusque pallidis; antennis 9-articulatis, clava uniarticulata, pyriformi, longitudine ad sex præcedentes conjunctim æquali.

Long. 4·5 mm.; lat. max. 2 mm.

Hab. E. SOCOTRA: Homhil, 1500–3000 ft. (*W. R. Ogilvie-Grant*).

This has the same elongate shape as the last, but is rather larger. The pattern is similar but the colour darker and the upper surface is not shining, being closely covered with large shallow pits, from which the scales arise. The latter are larger and nearly round. The eyes are not large and are separated by a space equal to their combined diameters, and the ocellus is small but prominent. The antennæ consist of nine joints, the first two globular, the third slightly elongate, the fourth to eighth minute, round and similar, and the ninth pear-shaped and equal in length to the six preceding.

Anthrenus frater, sp. n.

Oblongus, niger, squamis minutis angustis setiformibus nigris et albis dense tectus, pronoto subrectangulari, lateribus paulo explanatis, antice transversim elevato; antennis 11-articulatis, articulis omnibus transversis, tribus ultimis clavam abruptam fere rectangularem constituentibus.

Long. 2·5–3 mm.

Hab. TASMANIA.

This is very closely related to *A. ocellifer*, Blackb., with which alone it shares the peculiar oblong form, anteriorly elevated pronotum, and abruptly clubbed 11-jointed antennæ. It differs, however, in its more elongate outline and much smaller and more setiform scales. The pattern formed by these is very variable but like that of *A. ocellifer*. The front and hind margins of the pronotum are clothed with light scales, and these also form upon the elytra an anterior ring, an irregular median band and a posterior ring. These markings may become split up into small scattered patches, and brown scales may appear in addition to the black and white ones.

Genus APSECTUS.

Trinodes mexicanus, Reitter, is probably *Apsectus hystrix*, Sharp, described twenty-two years later, and in that case will become *Apsectus mexicanus*, Reitt.

This genus, which differs from *Trinodes* in not having the mesosternum channelled for the reception of a narrow prosternal process (which process is therefore also absent), is not confined to the Western Hemisphere, as might be supposed from the Catalogue. It is probable that numerous Oriental species exist. One at least of those at present referred to *Trinodes* must be transferred to it. This is *T. hirtellus*, Walker, in which the prosternum is very short and excised behind and the mesosternum entire and rounded in front to fit the prosternum.

Closely allied Oriental forms are the following, while another from Australia is yet undescribed :—

Apsectus iota, sp. n.

Parvus, late ovatus, pronoto haud angusto ; prosterno rectangulari, postice recte truncato, mesosterno lato, antice fere recte truncato ; antennis gracilibus (? maris), clava fusiformi, bi-articulata, articulo penultimo transverso, ultimo ovali, quam præcedenti quadruplice longiori.

Long. 1.5 mm.

Hab. TENIMBER IS. : Larat.

Three specimens were taken by Mr. F. Muir amongst an important collection of Coleoptera from this small Malayan island.

It is a species exceedingly like *T. hirtellus*, Walker, in size and general appearance, but rather more broadly oval, the pronotum especially being less narrowed. In the relation of the parts of the sternum it is also similar. As in *A. hirtellus*, the antenna (of the presumed male) ends with a large

elongate-oval joint, preceded by three transverse joints, but in the new species these three are much more distinctly articulated, and the last of them is enlarged almost to the diameter of the terminal joint and about a fourth of its length. About a dozen specimens of these two species which I have examined seem to be all of the same sex.

Apsectus indicus, sp. n.

Niger, nitidus, sat longe griseo-setosus, pedibus antennisque pallide flavis, harum clava biarticulata, brunnea; breviter ovatus, pronoto lato, lateribus antice valde contractis, postice late lobato, lobo truncato, antennarum clava haud compacta, articulo penultimo transverse ovali, ultimo paulo elongato, vix triplice majori.

Long. 1.5 mm.

Hab. BOMBAY: Belgaum (*H. E. Andrewes*).

This species has the closest resemblance to *A. hirtellus*, but the prothorax is rather more narrowed in front and its anterior margin has a pale semitransparent appearance. The lateral carinae slightly approach the lateral margins behind instead of diverging from them, and are therefore nearer the hind angles. The club of the antenna is quite different. The terminal joint is large, but oval, and still less elongate than in *A. iota*, the ninth and tenth (penultimate) joints are as in that species, the eighth not longer than it is wide.

Genus TRINODES.

Trinodes punctipennis and *globosus* of Macleay must be removed from the Dermestidae to the Byrrhidae. The former, of which Mr. Lea has sent me specimens compared with the type, proves to belong to the genus *Byrrhinus*, and the other must be supposed to be allied to it until evidence is found to the contrary. The fragmentary description is practically worthless.

Trinodes flavus, Motsch., Egypt (Bull. Soc. Nat. Mosc. xxxvi. 1863, ii. p. 433), has been omitted from all the catalogues. Its description is not really worthy of that name, but in the absence of any authoritative definition as to what constitutes a description the name can scarcely be ignored.

The description of *T. cinereohirtus*, Motsch., from Ceylon, although of much greater length, seems to contain scarcely more information of real significance. The species from Ceylon here described, although of the same size, is not suggested by anything else in that description. The phrase

"thorace valde transverso, densissime cinereo-villoso" seems to preclude the possibility of identity, and the elytra are not subattenuate at the apex.

Trinodes emarginatus, sp. n.

Obscure rufus, longissime fulvo-hirsutus, capite prothoraceque nigrescentibus; regulariter ovatus, prothorace antice attenuato, haud brevi, postice valde lobato, lobo distincte exciso, processu prosternali valido, triangulari, antennis gracilibus, clava laxè tri-articulata, articulo ultimo sat grandi, longe ovali, maris quam præcedenti quadruplice majori.

Long. 2 mm.

Hab. CEYLON: Kandy (*G. E. Bryant*, July 1908).

It has a close similarity to the European *T. hirtus*, but the hairy clothing is much longer, less abundant, and of a tawny colour. The elytra are much lighter in colour than the head and pronotum, and the posterior lobe of the latter is rather deeply excised. The antennæ are very slender, with a club of similar shape, the last joint in the male being about four times the length of its predecessor.

Trinodes rotundus, sp. n.

Niger, nitidus, sat late ovatus, globulus, ciliis griseis tenuibus haud dense vestitus; pronoto lato, brevi, marginibus lateralibus integris angustis; antennarum clava laxè moniliformi, articulis tribus globiformibus, ultimo cæterum magnitudine duplici.

Long. 2.3 mm.

Hab. S.E. BORNEO: Martapura (*Doherty*, 1891).

This is a large species of the same size as *T. rufescens*, Reitt., and more regularly oval and less contracted in front than any other species known to me, the pronotum being broad and rounded and the shoulders not prominent. The hairy clothing is less coarse and more scanty than in *T. hirtus* and *rufescens*, and consists of intermixed erect and prostrate hairs. The lateral margins of the pronotum are narrow, and the grooves entire and parallel to the sides. The club of the antenna consists of three very loosely connected globular joints, the last twice the diameter of either of the others. The structure of the sternum is really intermediate between the two extremes represented by typical forms of *Trinodes* and *Apsectus*. The prosternum has a posterior process, but this is very short and blunt, scarcely reaching beyond the front coxæ. Its tip enters a slight cavity in the mesosternum, but does not divide the latter as in the other species.

The three specimens are probably females.

XXXIX.—*On some Australian Malacodermidæ and Curculionidæ collected by Mr. G. E. Bryant.* By ARTHUR M. LEA.

[Concluded from p. 421.]

Curculionidæ (*continued*).

APIONIDES.

Apion nigroterminale, sp. n.

♂. Reddish castaneous; legs flavous; tip of rostrum, claws, and club more or less black, suture slightly infuscated. Moderately clothed with whitish pubescence, denser on sides of sterna than elsewhere.

Head with partially concealed punctures. Rostrum about the length of prothorax, moderately stout, lightly curved; apical two-thirds narrower than basal third and with smaller but not concealed punctures. Antennæ inserted about one-third from base of rostrum. *Prothorax* rather lightly transverse, sides rather strongly rounded in middle, with a shallow medio-basal fovea; punctures partially concealed. *Elytra* rather strongly punctate-striate, interstices with small punctures.

Length (excluding rostrum) $1\frac{1}{2}$ – $1\frac{2}{3}$ mm.

♀. Differs in having the rostrum considerably longer, thinner, darker, and less dilated near base.

Hab. New South Wales: Illawarra (G. E. Bryant), Sydney (C. Gibbons).

Distinguished from *anthidium*, *immundum*, and *solani* by its dark club; *solani* has the rostrum shorter in both sexes and *immundum* has it much longer in the female. In general appearance, however, it is fairly close to partially abraded specimens of *solani*. On the middle of the elytra the clothing is slightly darker than elsewhere, but the difference is rather slight, and there is no distinct pattern. The antennæ of the female are inserted at the same distance from the base of the rostrum as in the male, but, owing to the length of the rostrum itself, they are much more distant from its apex than in the male.

Apion longicolle, Lea.

A specimen from Illawarra differs from the type in having

the rostrum with the thin portion commencing nearer the base (this difference apparently being sexual) and in being somewhat smaller.

Apion vertebrale, Lea. Illawarra.

ATTELABIDES.

Euops bakewelli, Jek. Sydney.

E. eucalypti, Pasc. Illawarra.

E. victoriensis, Blackb. Sydney.

RHINOMACERIDES.

Auletes aterrimus, Lea. Illawarra.

A. brevisrostris, Lea. Illawarra.

A. densus, Lea. Illawarra.

MAGDALINIDES.

Magdalis stenotarsus, Lea. Sydney.

BALANINIDES.

Balaninus æqualis, Lea. Kuranda.

TYCHIIDES.

Tychius clavivarius, sp. n.

♂. Pale flavous, club black. Clothed all over with fine stramineous setæ; the upper surface, in addition, with stouter setæ, on the elytra linear in arrangement.

Head fairly large, with rather dense punctures. Eyes large, prominent, and coarsely faceted. Rostrum rather short, lightly curved; punctures partially concealed behind antennæ and small in front of same. Antennæ not very thin, inserted one-third from apex of rostrum. *Prothorax* moderately transverse, sides strongly and evenly rounded, base not much wider than apex; punctures dense and rather small. *Elytra* oblong-elliptic, about one-third wider than prothorax and about thrice as long, with regular rows of rather small punctures. *Abdomen* with first segment short, extremely narrow behind hind coxæ, second segment slightly shorter than first along middle, produced backwards

at sides. Pygidium distinct. *Legs* stout; femora obtusely dentate; middle tibiæ inflated near base, and narrowed thence to apex, hind tibiæ with an inner tooth and a small fascicle near apex; claws strongly appendiculate.

Length $2-2\frac{1}{4}$ mm.

♀. Differs in having the club no darker than the other parts of antennæ, abdomen more convex, with the basal segment wider behind hind coxæ and four hind tibiæ simple.

Hab. New South Wales: National Park (*G. E. Bryant*), Sydney (*H. W. Cox and A. M. Lea*).

In general appearance like some species of *Cyttalia*, but rostrum curved, scape shorter, and claws &c. different. In appearance it is something like a very large *T. horni*, which also has the club sexually variable in colour, but apart from size, with rostrum longer and thinner and clothing and legs different.

ARTEMATOCIS, gen. nov.

Head rather small. Eyes moderately large, coarsely faceted. Rostrum long, thin, and curved. Antennæ long and thin; first joint of funicle moderately long; club elliptic. *Prothorax* longer than wide or transverse. *Scutellum* small. *Elytra* moderately long, distinctly wider than prothorax. *Prosternum* notched in front, with a distinct canal in front of coxæ. *Metasternum* moderately long. *Abdomen* rather large, second, third, and fourth segments somewhat curved at sides. *Femora* moderately stout, edentate, shallowly grooved; front coxæ lightly separated; tibiæ compressed; claws appendiculate.

Distinguished from *Elleschus* by the front of the prosternum. The pectoral canal at once suggests the Cryptorhynchides, but the appendiculate claws forbid association with that subfamily. In general appearance the species are somewhat like some of *Storeus*, but in that genus the claws are simple. From some directions the claws, which are alike on both species, appear to be simple, but from others each is seen to have a large rounded basal appendix. The species differ considerably in the length of rostrum and width of prothorax, and it may eventually be considered necessary to generically separate them; this being the case, *A. longirostris* is designated the type of the genus.

Artematocis longirostris, sp. n.

Piceous brown; rostrum, antennæ, and tarsi more or less reddish. Densely clothed with muddy-brown scales, closely

applied to derm, and with numerous stiff erect setæ scattered about; under surface with whitish depressed setæ; legs with whitish scales and setæ.

Head with derm concealed. Rostrum thin, much longer than prothorax, moderately curved; in front of antennæ with small punctures, behind same with rows of punctures separating fine carinæ. Antennæ very thin; scape inserted one-third from apex of rostrum and almost as long as funicle and club combined; first joint of funicle stouter and somewhat longer than second. *Prothorax* slightly longer than wide, strongly convex, apex about two-thirds the width of base; with dense concealed punctures. *Elytra* oblong-cordate, much wider than prothorax; with rows of large, normally concealed punctures.

Length $2\frac{3}{4}$ mm.

Hab. Queensland: Kuranda.

In general appearance like *Storeus inamænus*, but larger, darker, and with the erect setæ longer.

Artematocis squamibundus, sp. n.

Piceous brown; apical half of rostrum, antennæ, and tarsi more or less reddish. Densely clothed with muddy brown scales, variegated with small whitish and sooty patches on elytra. With numerous stout suberect scales scattered about, mostly sooty brown on prothorax, but more variegated on elytra. Under surface with rather sparse whitish scales. Legs densely clothed.

Head with derm concealed. Rostrum rather long, moderately curved, apical third with small but distinct punctures, elsewhere with rows of punctures separating carinæ, but towards base more or less concealed. Antennæ thin, inserted about one-third from apex of rostrum; first joint of funicle longer than second and third combined. *Prothorax* about one-third wider than long, sides gently rounded, base and apex subequal; with dense concealed punctures. *Elytra* oblong-cordate, base lightly trisinate, and distinctly wider than prothorax; punctures normally concealed.

Length 3 mm.

Hab. Queensland: Kuranda.

Readily distinguished from the preceding species by its shorter and stouter rostrum and much wider prothorax.

Elleschodes V-albus, sp. n.

Reddish castaneous, sides of prothorax, under surface, and part of front femora much darker. Moderately densely

clothed with stout, depressed, whitish setæ, with darker markings.

Head with concealed punctures. Eyes large and coarsely faceted. Rostrum moderately stout and curved, almost parallel-sided, slightly longer than prothorax; with rows of punctures bearing a distinct median carina, and two feeble ones on each side. Antennæ rather thin, inserted one-third from apex of rostrum; scape the length of funicle; first joint of the latter stout and slightly longer than second and third combined. *Prothorax* not much wider than long, sides evenly rounded, base not much wider than apex, and both truncate; with dense, partially concealed punctures. *Elytra* subcordate, about one-fourth wider than prothorax and about thrice as long, shoulders and sides gently rounded, widest near base; with rows of fairly large, partially concealed punctures, the interstices with normally quite concealed ones. Under surface with rather dense punctures. Abdomen with second to fourth segments distinctly drawn backwards at sides. *Femora* stout, lightly but acutely dentate; appendages to claws rather large.

Length $2\frac{1}{4}$ mm.

Hab. Queensland: Kuranda.

A pretty little species, not very close in appearance to any other known Australian species. On the middle of the prothorax the clothing is white, with, on one specimen, a tendency to a linear arrangement, but on the sides it is almost sooty. On the elytra there is a fairly wide median fascia of dark clothing, slightly produced backwards along the suture, and with the sides oblique. Immediately behind it the clothing is whiter than elsewhere, so that it forms a distinct wide V. There are some stouter setæ amongst the others, but they are not distinctly elevated.

Elleschodes macrops, sp. n.

Piceous brown; legs and antennæ reddish, funicle and tarsi (claw-joints excepted) somewhat darker. Rather densely clothed with stramineous setæ.

Head with concealed punctures. Eyes rather large, coarsely faceted, separated about half the width of base of rostrum. Rostrum slightly longer than prothorax, rather thin, lightly curved, parallel-sided; with rows of partially concealed punctures separating narrow carinæ that terminate between antennæ, where the median one is narrowly cleft; apical third with fairly dense punctures of moderate size and sharply defined. Antennæ rather thin, inserted about one-

third from apex of rostrum; scape slightly longer than funicle; the basal joints of the latter moderately long, subequal in length, but the first slightly stouter than the second. *Prothorax* quite as long as wide, base decidedly wider than apex; with dense and rather coarse punctures, partially concealed on disc, and quite concealed on sides. *Elytra* subcordate, much wider than prothorax, and not thrice as long, shoulders rounded, sides parallel on basal third and then rounded to apex; with rows of fairly large, suboblong, deep punctures; interstices with numerous partially concealed punctures. Under surface with dense and rather coarse but partially concealed punctures. Abdomen with second to fourth segments curved at sides. *Femora* stout, lightly but acutely dentate; appendages to claws large and obtuse.

Length $4\frac{3}{4}$ mm.

Hab. Queensland: Kuranda.

The clothing on the prothorax is thinner at the middle than elsewhere, but on the sides might fairly be regarded as composed of scales. On the elytra just behind the middle the setæ are somewhat congested and stouter than usual, so that to the naked eye they appear to form a feeble fascia. The rows of punctures on the elytra are quite regular, but the striation is extremely feeble and might fairly be regarded as absent.

The dentate femora would, in the table of Australian Tychiides*, associate this and the following species with *Elleschodes*, to which, accordingly, they are referred. It is to be noted, however, that that genus includes several very diverse forms, and probably some of these will eventually be referred to new genera. I am averse to proposing such at present, as there are many undescribed species of the subfamily in Australia, more especially in the tropical parts.

Elleschodes hystricosus, sp. n.

Reddish castaneous, antennæ and legs somewhat paler. Rather densely clothed with short, depressed, stramineous setæ. With numerous rather long, suberect, and almost golden setæ, on head and elytra directed backwards, on prothorax directed to the middle. Under surface and legs less densely clothed than upper.

Head with concealed punctures. Eyes not very large, but rather prominent and coarsely faceted. Rostrum somewhat

* Trans. Roy. Soc. S. Aust. 1911, p. 85.

longer than prothorax, rather thin, parallel-sided, moderately curved; in front of antennæ with fairly dense punctures, behind antennæ with rows of punctures separating narrow carinæ. Antennæ rather thin, inserted slightly nearer apex than base of rostrum; first joint of funicle stout. *Prothorax* moderately transverse, sides strongly and evenly rounded, base slightly wider than apex; with dense, partially concealed punctures. *Elytra* oblong-elliptic, about one-fourth wider than prothorax and more than thrice as long. *Under surface* with mostly small punctures. *Abdomen* with second to fourth segments lightly drawn backwards at sides. Pygidium small, but distinct. *Femora* stout, acutely dentate, appendages to claws large.

Length $1\frac{1}{2}$ mm.

Hab. Queensland: Kuranda.

Vague traces of rows of punctures are traceable through the elytral clothing, but on the interstices they are quite concealed.

Elleschodes eucalypti, Lea. National Park.

LÆMOSACCIDES.

Lamosaccus subsignatus, Boh. Illawarra.

L. querulus, Pasc. Blue Mountains, Sydney, National Park.

L. instabilis, Lea. Sydney, National Park.

L. judaicus, Lea. Baan Baa.

ALCIDIDES.

Alcides bubo, Fabr. Townsville.

HAPLONYCIDES.

Haplonyx mediochreatus, sp. n.

Dark reddish brown, in parts almost black; antennæ and legs dull reddish. Moderately densely clothed with white or whitish scales; prothorax with somewhat ochreous scales on sides; two very small blackish fascicles in middle and two still more feeble ones at apex; elytra with a conspicuous median patch of ochreous scales; third interstice with two small fascicles, one near base and one at side of ochreous patch; fifth with a small fascicle near base.

Rostrum about as long as prothorax in male, distinctly

longer in female; parallel-sided, almost straight; with dense punctures and three narrow carinæ. *Prothorax* about twice as wide as long, sides rapidly decreasing in width to apex; with dense punctures. *Elytra* not much wider than prothorax, about as long as wide; with rows of large partially concealed punctures; interstices with dense punctures. *Femora* acutely dentate, the four front ones each with a small tooth in the emargination; tibiæ moderately curved, bisinuate on lower surface, with a small subapical tooth in addition to the terminal hook.

Length $2\frac{1}{2}$ – $2\frac{3}{4}$ mm.

Hab. Queensland: Kuranda (G. E. Bryant); Brisbane (H. Hacker).

The conspicuous ochreous patch on the middle of the elytra renders this a rather distinct species.

Haplonyx fasciculatus, Boh. Blue Mountains, Sydney, National Park.

H. schonherri, Boh. Blue Mountains.

H. kirbyi, Ths. Blue Mountains.

H. nigrirostris, Chev. Blue Mountains.

H. sexvittatus, Chev. Blue Mountains.

H. vicinus, Chev. Blue Mountains, Sydney, Illawarra.

H. latus, Lea. Blue Mountains.

Haplonyx (Aolles) sobrius, sp. n.

Piceous brown, in places almost black; antennæ reddish. Moderately clothed with sooty-brown and whitish scales.

Rostrum about the length of prothorax, almost straight, feebly diminishing in width to apex, with dense punctures and fine narrow carinæ. Funicle six-jointed. *Prothorax* twice as wide as long, sides strongly narrowed to apex, which is feebly incurved to middle; with dense punctures. *Elytra* no longer than wide, with rows of large, partially concealed punctures; interstices densely punctured. *Legs* very short; femora unidentate; four front tibiæ strongly bisinuate on lower surface; third tarsal joint about twice as wide as long, fourth apparently absent.

Length $3\frac{1}{4}$ – $3\frac{1}{2}$ mm.

Hab. Queensland: Kuranda.

Allied to *puncticollis*, but much darker, and with different clothing. The (two) typical specimens have the scales on under surface, both of body and of legs, almost entirely

white or whitish. On the upper surface the white scales are scattered singly on the head and rostrum, condensed into a feeble line on each side of prothorax, form a distinct spot on each side of scutellum, and some very feeble ones elsewhere. The shoulders are rather strongly rounded, so that, although the elytra at their widest are distinctly wider than the prothorax, their outlines appear to be almost continuous with those of that segment. The lower surface of each of the four front tibiæ appears to have three distinct equal-sized teeth: one in middle, one near and one at apex, but the latter one is the terminal hook.

Haplonyx (Aolles) variegatus, Lea. Blue Mountains.

Sigastus casuarinæ, Lea. Sydney.

CRYPTORHYNCHIDES.

Diethusa tuberculata, sp. n.

♂. Reddish castaneous. Clothed with white, ochreous, and sooty scales.

Rostrum moderately long, parallel-sided, with dense, clearly defined punctures in front of antennæ; behind same coarser, sublineate in arrangement, but concealed towards base; with a narrow median carina. Scape inserted about two-fifths from apex of rostrum, and distinctly shorter than funicle; first joint of funicle stouter and longer than second. *Prothorax* moderately transverse, and punctures normally almost concealed. *Elytra* subcordate, base strongly trisinate, with rows of suboblong, partially concealed punctures, interstices nowhere ridged. *Abdomen* with basal segment somewhat flattened, but the middle of its apex with a narrow but distinct tubercle; apical segment with a large shallow depression. *Femora* stout, rather lightly dentate; front tibiæ subfalcate, lower surface somewhat grooved, apical hook unusually strong.

Length $2\frac{1}{2}$ –3 mm.

♀. Differs in having the clothing less variegated, rostrum somewhat thinner and with smaller punctures, abdomen with basal segment convex and non-tuberculate, the apical segment evenly convex, front tibiæ not falcate, and the apical hook small.

Hab. New South Wales: Sydney (G. E. Bryant and E. W. Ferguson).

The male has the front tibiæ somewhat as in *Melanterius congruus*, but is readily distinguished from that species, and

from all others of the allied genera, by the abdominal tubercle. Some specimens resemble some of *D. concinna*, *D. nigrovaria*, and *D. fumelica*. It has been referred to *Diethusa* on account of its compact form and dense clothing. The clothing on the under surface is white, and on the legs white or in parts pale ochreous. On the prothorax there is usually a large sooty patch in the middle, ochreous scales at the sides of same, and then white ones. On the elytra the ochreous scales are in the majority, but there are numerous spots or fasciæ of sooty scales, and almost equally numerous white spots. On the female the sooty spots are sometimes entirely absent, on such specimens the majority of the scales on the upper surface are somewhat golden, mixed with spots of white.

Diethusa metasternalis, sp. n.

♂. Reddish castaneous. Clothed with scarlet and stramineous scales on upper surface, under surface mostly with white scales, but with a conspicuous line of golden setæ.

Rostrum rather long, thin, and parallel-sided; on basal half with coarse punctures in lines, elsewhere with smaller but clearly defined ones. *Scape* thin, the length of funicle, inserted one-third from apex of rostrum, first joint of funicle about as long as second and third combined; club rather large and wide. *Prothorax* lightly transverse; with dense, partially concealed punctures. *Elytra* subcordate, base strongly trisinuate; with rows of large, partially concealed punctures; interstices wide, with dense, normally concealed punctures, the lateral ones, commencing with the seventh, more or less distinctly ridged along middle; suture acutely carinated. *Metasternum* and basal segment of *abdomen* with a deep sulcus containing the line of golden setæ; apical segment with a wide shallow impression. *Femora* stout and strongly dentate.

Length 4-4½ mm.

♀. Differs in being rather more robust, rostrum decidedly longer, thinner, and smoother, with smaller and sparser punctures, antennæ inserted not so close to apex of rostrum, metasternum and abdomen not sulcate in middle, and without the line of setæ, apical segment not impressed, and four front tibiæ with the apical hook to each commencing at the summit of the apical slope, instead of more than halfway down the same.

Hab. New South Wales: Ourimbah and Sydney (*G. E. Bryant*), Sydney (*H. W. Cox*).

On the male of *blackburni* there is a peculiar streak of clothing on the metasternum and abdomen, but on that species the main portion of it is on the abdomen, whereas on this species it is on the metasternum; there are other differences also, in addition to the very different clothing of the upper surface. The clothing of both prothorax and elytra is much like that of some specimens of *squamivaria*, but it is readily distinguished from that species by the undersurface of the male; the females of the two species, however, are extremely alike, and I can find no satisfactory characters to distinguish them. It is also close to *pretiosa*, but that species has the under surface of the male, and the rostrum of the female, very different. On the upper surface most of the scales are scarlet, the stramineous ones (sometimes almost white) are in numerous small spots on the elytra, and form two spots down middle of prothorax, several on each and one on each side of middle. Each sutural interstice is acutely carinated, the carina on each being quite close to its fellow, so that the suture itself appears to be closely bicarinated throughout its length.

The female of this species was previously given to me as belonging to the one I described under the name of *Lybaena acuticosta* (= *Diethusa ferrida*), but this was certainly in error.

Diethusa niveodispersa, sp. n.

Reddish castaneous, under surface and parts of legs darker. Densely clothed with sooty scales, with white scales scattered thickly about and on the elytra more or less linear in arrangement; under surface of body and of legs with snowy scales.

Rostrum long, thin, and feebly dilated from base to apex; behind antennæ with rows of punctures and feeble carinæ, in front of same with dense punctures. *Scape* thin, the length of funicle, inserted two-fifths from apex of rostrum; first joint of funicle slightly longer than second. *Prothorax* moderately transverse, with dense punctures. *Elytra* briefly subcordate, base strongly trisinate, with rows of oblong punctures, in rather narrow striæ; interstices wide, nowhere ridged, with dense, normally concealed punctures. Basal segment of *abdomen* depressed in middle; apical with a shallow impression. *Femora* stout, strongly and acutely dentate, each with a small granule in subapical emargination; front tibiæ bisinuate on lower surface, the others subfalcate.

Length 4 mm.

Hab. New South Wales; Baan Baa.

The peculiar clothing and entire absence of elevated parts on the elytra are at variance with *Melanterius*; but many species of *Diethusa* have similar interstices, so I have referred it to the latter genus. The second segment of abdomen is, if anything, a trifle longer than the third and fourth combined, but only about half the length of the first. Although the white scales are numerous on the upper surface, they are nowhere condensed into distinct spots. The type is probably a male.

Diethusa tenuirostris, sp. n.

♂. Blackish brown; antennæ, legs, and tip of rostrum reddish. Densely clothed with sooty-brown scales, with numerous spots or patches of whitish scales; becoming almost uniform on under surface and legs.

Rostrum long, thin, and parallel-sided to insertion of antennæ, thence narrowed to apex; with coarse concealed punctures behind antennæ, smaller and clearly defined in front of same. Scape inserted two-fifths from apex of rostrum, somewhat shorter than funicle; first joint of funicle slightly longer than second. *Prothorax* moderately transverse; with dense, normally concealed punctures. *Elytra* subcordate, base moderately trisinate, basal half parallel-sided; with suboblong punctures, in narrow deep striae; interstices wider, nowhere ridged, with dense and rather coarse, but normally quite concealed, punctures. Basal segment of *abdomen* feebly concave in middle; apical segment widely impressed. *Femora* rather stout, edentate.

Length 2 mm.

♀. Differs in having the rostrum longer and much thinner, clothed only at extreme base, almost impunctate, almost entirely red, and antennæ inserted quite close to its base. Abdomen with basal and apical segments convex, and femora somewhat thinner.

Hab. New South Wales: Sydney.

The rostrum is conspicuously different sexually, much as in many species of *Storeus*. The clothing, although of different shades of colour, has the peculiar soft appearance of that of *mollis*, but that species has conspicuously dentate femora. In the present species the hind femora appear to have a feeble ridge that causes them to appear feebly dentate from certain directions, but it is not a real tooth. From *inermis* it differs in its much smaller size and very different clothing, rostrum of the female thinner, but not subulate, &c.

Diethusa æstuans, Pasc. Perth.

D. squamivaria, Lea. Ourimbah, Baan Baa, Sydney.

Melanterius rufimanus, sp. n.

Black, shining; antennæ and tarsi red. Upper surface almost glabrous; lower surface with rather sparse white setæ, becoming denser on legs.

Eyes moderately separated. Rostrum long and thin; with distinct punctures near base, but elsewhere very small and sparse. Scape inserted about three-sevenths from apex of rostrum, almost the length of funicle; first joint of funicle stouter, but no longer than second. *Prothorax* almost as long as wide; with dense and clearly defined, but rather small punctures. *Elytra* subcordate, shoulders and sides rather strongly rounded; with not very large, sub-oblong punctures, becoming smaller posteriorly; interstices much wider than punctures, acutely ridged from near middle to apex, but the lateral ones almost to base, with sparse and small punctures. Basal segment of *abdomen* feebly depressed in middle of apex. *Femora* stout, strongly dentate; tibial hooks rather strong.

Length $4\frac{1}{2}$ mm.

Hab. New South Wales: Baan Baa.

In general appearance close to *semiporosus*, but narrower, elytral punctures not quite the same, and femoral dentition (notably of the front pair) much stronger. In my table would be associated with *porosus*, which has a much shorter rostrum, antennæ stouter, with club subcontinuous with funicle, abdomen with larger punctures, elytral punctures larger, second interstice carinated only posteriorly and femoral dentition less conspicuous. The type is probably a female.

Melanterius porcatus, Er. Port Darwin.

M. acaciæ, Lea. Mordialloc, Sydney, Illawarra.

M. adipatus, Lea. Illawarra, Ourimbah.

M. costipennis, Lea. Sydney.

M. strabonus, Lea. Port Darwin.

M. tristis, Lea. Sydney.

M. vulgivagus, Lea. Kuranda.

Melanteriosoma costatum, Lea. Ourimbah.

Tyrtæosus melanterioides, sp. n.

Black; antennæ and tarsi of a dingy red. Rather sparsely clothed (denser on sterna and legs than elsewhere) with dingy greyish and sooty scales.

Head with coarse crowded punctures. Eyes separated less than width of base of rostrum, a rather narrow and deep but partially concealed depression behind each. Rostrum moderately long; basal third with coarse, partially concealed punctures, elsewhere with smaller (but not very small) sharply defined ones. *Prothorax* moderately transverse, sides strongly rounded, subapical constriction stronger than usual; with dense, large, round, non-confluent punctures; median carina distinct, but somewhat irregular in middle. *Elytra* cordate, about one-fourth wider than prothorax, subhumeral incurvature very feeble; with very coarse sculpture. *Metasternum* with a strong ridge on each side between coxæ; punctures of episterna interrupted. *Abdomen* with dense and rather coarse punctures, not in regular rows on third and fourth segments. *Legs* stout; femora moderately grooved and rather strongly dentate; hind tibiæ strongly dilated to apex, the others lightly so.

Length $7\frac{1}{4}$ –8 mm.

Hab. New South Wales: Blue Mountains (G. E. Bryant and E. W. Ferguson), Nowra (Ferguson).

In general appearance strikingly like some of the larger species of *Melanterius* (e. g., *semiporcatus*). On the basal half of the elytra the punctures are unusually coarse, large, and long, so that from base to middle there are only from four to six in each row; the interstices there are also much narrower than the punctures, and on some specimens are irregularly depressed between two of the punctures, so that these appear to be semi-double. On the basal half also the transverse ridges between the punctures are on a level with the interstices, so that striæ are really absent; on the apical half, however, the striation is distinct, and the punctures, although large, are considerably smaller, and without a semi-double appearance. The basal segment of the abdomen is gently depressed in the middle in the male and very feebly convex in the female; otherwise the sexes are scarcely distinct.

Tyrtæosus albolineatus, sp. n.

Black, in parts very obscurely diluted with red; antennæ and tarsi red. Prothorax with a dingy depressed scale in each puncture, but with a feeble median line of whitish

elongate scales ; elytra with lines of white scales on the second and fourth interstices. Legs with whitish setæ ; under surface sparsely clothed.

Head with some fairly large punctures between eyes, but elsewhere small and sparse. Eyes widely separated, a narrow impression behind each. Rostrum moderately long, sides lightly incurved to middle ; about basal fifth with some large punctures, elsewhere with much smaller ones. *Prothorax* moderately transverse, apex more than half the width of base ; with fairly large and rather dense, round, non-confluent punctures ; median carina very feeble and scarcely traceable throughout. *Elytra* elongate-cordate, not much wider than prothorax, subhumeral incurvature very feeble ; with rows of somewhat oblong punctures, in rather deep striæ ; interstices flat, wider than striæ, with a feeble row of punctures on each. *Metasternum* with an obtuse ridge on each side between coxæ ; punctures of episterna interrupted. *Abdomen* with first segment depressed along middle, and about as long as second and third combined, third and fourth each with a row of punctures across middle. *Legs* rather long ; femora lightly but acutely dentate ; hind tibiæ moderately dilated at apex.

Length 3 mm.

Hab. Queensland : Kuranda.

To a certain extent resembling the species of *Tyrtæosellus*, but legs shorter, hind tibiæ wider at apex than elsewhere and emargination of mesosternal receptacle widely transverse. At a glance it looks like a small narrow *Melanterius*. The type (judging by the abdomen) is probably a female.

Tyrtæosus amulus, Lea. Blue Mountains.

T. cinerascens, Lea. Blue Mountains.

Neomystocis latipennis, sp. n.

♂. Black ; antennæ and tarsi of a rather dingy red. Densely clothed with muddy-brown or sooty scales, variegated with somewhat ochreous ones ; with stouter scales thickly scattered about on legs and prothorax ; elytra with numerous feeble fascicles, mostly of ochreous scales.

Head with coarse, partially concealed punctures. Rostrum long and thin, almost parallel-sided ; behind antennæ with feeble rows of coarse, partially concealed punctures, in front of same shining, and with rather small but clearly defined ones. Antennæ not very thin, inserted slightly nearer apex than base of rostrum ; second joint of funicle slightly longer

than first; club elliptic, the length of five preceding joints combined. *Prothorax* small, moderately transverse, sides moderately rounded; with dense, normally concealed punctures; with a short and partially concealed median carina. *Elytra* much wider than prothorax, base trisinate, parallel-sided to about the middle; with rows of large, more or less concealed punctures; third interstice with a rather large elongated tubercle about the middle, fourth with a rather more obtuse one at basal fourth, fifth with a rather feeble one level with the one on third; elsewhere with very feeble tubercular swellings. *Pectoral canal* and mesosternal receptacle transversely corrugated. Metasternum foveate at apex. *Abdomen* with first segment very little longer than second, middle of apex depressed and suture there strongly incurved, second slightly longer than third and fourth combined. *Legs* rather long; femora acutely and moderately dentate, hind ones passing apex of elytra.

Length $6\frac{1}{2}$ mm.

♀. Differs in being larger ($9\frac{1}{2}$ mm.) ; rostrum thinner with less clothing on basal portion, apical portion with much smaller and sparser punctures; antennæ inserted in exact middle of rostrum; metasternal fovea smaller smaller, basal segment of abdomen gently convex, and legs somewhat shorter.

Hab. Queensland: Kuranda.

Differs from *squamiventris* in the pectoral canal being corrugated and non-squamose along middle, second abdominal segment larger in proportion, clothing and tubercles different, legs shorter, &c. The large elytral tubercles are supplied with granules, but these are normally concealed by the fascicles. The femoral teeth, although fairly large, are normally indistinct on account of the clothing.

Neomystocis squamiventris, Lea.

The type of this species was described from a female in rather poor condition; but two specimens from Kuranda taken by Mr. Bryant are evidently perfect, as are also some from the same locality taken by Mr. F. P. Dodd. These specimens have the upper surface densely clothed with slaty green rounded scales, interspersed with some snowy-white ones, and with two black fascicles on the prothorax and several on the elytra.

The male differs from the female in having the rostrum slightly shorter, with more distinct punctures, and the clothing continued along its sides to in front of the middle.

Its mesosternal receptacle has its hind margin almost vertical instead of flattened out, the sides somewhat thicker, and crowned with rather long erect setæ, and there are similar setæ on the adjacent coxæ. Its abdomen has the basal segment largely depressed in the middle, and the second to fourth segments have a continuous highly polished space along the middle (in the female this is represented by a shining space at the tips only). Its legs also are a trifle longer, but are otherwise the same.

Hyparinus brevipes, sp. n.

Black; antennæ and tarsi of a dingy red. Moderately densely clothed with muddy-brown scales; with longer (and usually paler) ones thickly scattered about on the legs and prothorax, and on the latter forming feeble fascicles; elytra with fascicles or tubercles.

Head with forehead strongly quadrisinuate. Rostrum rather long and thin, strongly curved; from antennæ to base somewhat inflated and with rows of coarse partially concealed punctures, in front of antennæ parallel-sided, shining, and impunctate. Scape short, clavate, inserted one-third from base of rostrum, shorter than three following joints combined; two basal joints of funicle rather long and subequal, none of the others transverse. *Prothorax* moderately transverse, sides strongly rounded; with dense, normally concealed punctures. *Elytra* about one-third wider than prothorax, base strongly trisinuate, basal half parallel-sided; with rows of large, partially concealed punctures, each with five distinct tubercles and some smaller ones. Basal segment of *abdomen* flat in middle, but middle of apex feebly depressed, and suture there slightly incurved, second as long as third and fourth combined. *Femora* stout, strongly and acutely dentate, hind ones just passing tip of elytra; tibiæ rather wide and compressed, rounded on their upper edge, bisinuate on the lower.

Length 7–8 mm.

Hab. Queensland: Kuranda (*G. E. Bryant*), Cairns (*E. Allen*), Little Mulgrave River (*H. H. D. Griffith*).

Smaller than *dispar* and *temuirostris*: from the former distinguished by the longer second abdominal segment, shorter hind femora, and absence of sutural granules; from the latter by the tips of the hind femora just passing apex of elytra instead of considerably so, and prothorax with denser clothing. On each elytron the distinct tubercles are as follows:—Two on the second interstice (one before and one

after the middle), one on the third near base (this one partly on the second and fourth as well), one on the fourth at middle, and one on the fifth near the one on third. There are ten specimens before me, apparently without distinct sexual differences. Some have the basal segment of abdomen lightly convex, but, as their antennæ and rostrum are as on the others, I presume this to be an individual rather than a sexual variation.

Pezichus gracilis, Lea.

Mr. Bryant took two specimens of this species at Kuranda. They are females, and differ from the type, which is certainly a male *, in being somewhat larger, rostrum slightly longer and thinner, with the coarse punctures not quite extending to middle; antennæ inserted about one-third from apex of rostrum, and scarcely passing apex for one-fourth of its length, and legs a trifle shorter. On the third interstice of both sexes there is an elongated median fascicle of dark scales, terminated by pale ones.

Pezichus binotatus, Waterh. Kuranda.

Glochinorrhinus evanidus, Lea. Kuranda.

Blepiarda undulata, Pasc. Tweed River.

Dysopirhinus grandis, Lea. Kuranda.

MICRAONYCHUS, gen. nov.

Head moderately large, scarcely visible from above. *Eyes* rather small, round, frontal, distant, rather coarsely faceted. *Rostrum* long, thin, and curved. *Antennæ* thin, inserted about middle of rostrum; scape shorter than funicle; club ovate. *Prothorax* moderately long, sides in front rather strongly drawn backwards, but ocular lobes distinct. *Scutellum* minute. *Elytra* more or less parallel-sided, very little wider than prothorax. *Pectoral canal* deep and distinct, continued almost to middle of metasternum; apex open. *Metasternum* rather long, episterna narrow. *Abdomen* rather long, first, second, and fifth segments large, the others short. *Legs* rather short; femora edentate; tarsi short, third joint wide, feebly bilobed or rounded, claw-joint absent. Elongate, squamose, non-tuberculate, winged.

The pectoral canal completely separates the two front pairs

* It was considered originally that the type was probably a female.

of coxæ to their extreme depth, as in other Cryptorhynchides, but the mesosternum has no special receptacle for the rostrum, this simply resting in the hollowed-out space (as in *Microberosiris* and *Dystropicus*). In *Aonychus* (the only other Australian genus of Cryptorhynchides with clawless tarsi) there is a narrow ridge between the middle coxæ, that genus also has special processes attached to the hind portion of the prosternum. In catalogue the genus should be placed next to *Dystropicus*.

The genus is another instance of the decided affinity of the Cryptorhynchides to the Eriirhinides. Several Australian genera (*Cydmaea*, *Storeus*, and *Misophrice*) have species with the front coxæ not quite touching and with more or less feeble traces of a pectoral canal; but in the present genus the canal is deep and distinct, so that it could not properly be referred to the Eriirhinides.

The joints of the antennæ are evidently eleven in number, but it is somewhat difficult to decide as to whether the eighth joint should be regarded as belonging to the funicle or to the club. It is more triangular in shape than the seventh (the sixth of the funicle) and rather closely applied to the club, its clothing causing it to appear more closely attached than it really is. The three true joints of the club, however, are compacted together, so it would, perhaps, be as well to regard the eighth joint as belonging to the funicle and the latter, in consequence, to be seven-jointed.

The clawless tarsi, apparently six-jointed funicle, general appearance, and food-plants (most of the specimens, if not all, taken by myself were beaten from various species of *Casuarina*, the host-plants of *Misophrice*) are in agreement with *Misophrice*, and, in fact, caused me to overlook such of the species as I then possessed when at work on the group of Cryptorhynchides to which they belong; and it was only when preparing some specimens of *Misophrice* for description that their true relationship was noticed.

Only three specimens, belonging to two species, were taken by Mr. Bryant, but, as the genus is a very interesting one, it appears desirable to describe all the species known to me together.

All the known species have the rostrum glabrous and the antennæ (except the scape) and tarsi black. The genus occurs in South Australia, but the only specimen I have seen from that State (in the collection of Mr. Griffith) is rather badly abraded.

Third interstice slightly elevated in parts	<i>sordidus</i> .
Third interstice not so elevated.	
Rostrum black	<i>nigrirostris</i> .
Rostrum red.	
Elytra distinctly spotted	<i>maculatus</i> .
Elytra not distinctly spotted.	
Clothing of upper surface mostly sooty	<i>casuarinæ</i> .
Clothing of upper surface mostly pale.....	<i>decipiens</i> .

Micraonychus decipiens, sp. n.

Dull red; funicle, club, and tarsi black. Clothed with more or less whitish scales.

Rostrum the length of prothorax; with rather small punctures. *Prothorax* about as long as wide, sides moderately rounded, with dense, normally concealed punctures. *Elytra* elongate, parallel-sided to near apex; with rows of large, partially concealed punctures, in feeble striae. *Under surface* with dense and rather coarse, but normally more or less concealed punctures.

Length 2-2½ mm.

Hab. Tasmania: Hobart. New South Wales: Mount Victoria (*A. M. Lea*), Blue Mountains (*E. W. Ferguson*).

On old or abraded specimens the clothing of the upper surface is of a more or less dingy grey, but on ones in good condition it is white or stramineous. On the prothorax it is denser along middle than elsewhere; on the elytra the scales on some of the interstices are dense and obliquely overlap, as on *Misophrice alternata*. On the sides of the sterna the clothing is denser than elsewhere, and is usually silvery in appearance, but occasionally with a faint purplish or greenish gloss. The scales on the legs also are sometimes faintly glossed with green or purple. In the female the rostrum is slightly longer than in the male and its punctures are even less distinct.

Micraonychus nigrirostris, sp. n.

Black. Densely clothed with large, round, and usually pale scales.

Length 1½-2 mm.

Hab. Tasmania: Hobart. New South Wales: National Park, Sydney, Mount Victoria (*A. M. Lea*).

Rather smaller than the preceding species, but with the shape of the prothorax and elytra and the punctures the same, but differing in the colour and clothing. From all others of the genus it is readily distinguished by its entirely black rostrum. The scape is not quite as dark as the rest of

the antennæ. The scales are nearly all quite circular in outline; on fresh specimens they are mostly white, with a slight bluish tinge, but they often have a coppery gloss, varying with the point of view. On one specimen the scales are unusually dense and of a beautiful golden colour with a slight rosy gloss. On old and abraded specimens, however, the clothing looks very dingy, with here and there one metallic scale showing up distinctly. Some of the more brightly coloured specimens have a strong resemblance to some specimens of *Misophrice gloriosa*, in whose company they were probably taken.

Micraonychus casuarinæ, sp. n.

Dull red; funicle, club, and tarsi black. Densely clothed with sooty-brown scales; the under surface and under parts of legs with whitish or greyish scales.

Rostrum long and thin; a seriate row of punctures on each side of basal half. *Prothorax*, *elytra*, and *under surface* with sculpture as in *decipiens*, but more concealed by clothing.

Length 2-2½ mm.

Hab. New South Wales: Illawarra (G. E. Bryant). Wollongong, Parramatta River, on Casuarinas growing just above high-water mark (A. M. Lea).

The derm of the prothorax and elytra is normally entirely concealed, but on abrasion is seen to be of a dingy red; the prothorax somewhat darker than the elytra. On the under surface of body and of legs many of the scales are of a silvery white, sometimes with a faint greenish or coppery gloss; but on the upper surface the scales are either uniformly sooty brown or with a feeble admixture of grey. The rostrum appears to have a fine stria on each side, but these are really due to series of confluent punctures. In the male the rostrum is shorter than in the female and somewhat clouded at the base, but the sexual differences are not otherwise evident.

Micraonychus maculatus, sp. n.

Reddish; tarsi, funicle, and club black. Densely clothed with soft and mostly white or whitish scales, but on the elytra mostly of a pale brown.

Length 1½-2 mm.

Hab. Queensland: Brisbane (G. E. Bryant). New South Wales: Sydney (H. J. Carter and Taylor Bros.).

The sculpture is practically identical with that of *decipiens*,

but the clothing is rather denser. On the prothorax there is an obscure dark line on each side of the middle; on the elytra the suture is clothed with whitish scales, and there is an irregularly transverse or zigzag series of pale spots or short lines across the middle; the shoulders and preapical callosities are also clothed with whitish scales. On the under surface some of the scales have a slight silvery or coppery gloss.

Micraonychus sordidus, sp. n.

Of a dingy reddish brown; base of rostrum, funicle, club, and tarsi black. Densely clothed with muddy-grey scales, feebly variegated with paler ones on elytra, under surface, and legs.

Rostrum long and thin, with very minute punctures. *Prothorax* lightly transverse; with dense, normally concealed punctures. *Elytra* not very narrow, parallel-sided to beyond the middle; with rows of large, almost entirely concealed punctures; third interstice slightly elevated at base, near middle, and at summit of posterior declivity. *Under surface* with dense, normally concealed punctures.

Length $2\frac{3}{4}$ mm.

Hab. Queensland: Brisbane (*H. W. Cox*).

A rather robust species and the largest of the genus. The type has the prothorax somewhat abraded, but its comparatively large size and slight inequalities of the third interstice (some of the others are also slightly uneven) should prevent its being confused with the other species.

Mechistocerus cancellatus, Lea. Kuranda.

M. duplicatus, Lea. Kuranda.

Tepperia sterculiæ, Lea. Baan Baa.

Poropterus lithodermus, Boi. Kuranda.

P. astheniatus, Lea. Blue Mountains.

P. intermedius, Lea. Kuranda.

P. orthodoxus, Lea. Illawarra.

Microporopterus regularis, Lea. Blue Mountains.

Salcus elevatus, Pasc. Kuranda.

Imaliodes ovipennis, Lea. Kuranda.

I. subfasciatus, Pasc. Illawarra, Blue Mountains.

Tentegia ingrata, Faust. Kuranda.

Tragopus plagiatus, Pasc. Kuranda.

Nechyrus incomptus, Pasc. Illawarra.

N. mollipes, Lea. Kuranda.

Onidistus subformicatus, Lea. Kuranda.

Exithius fumatus, Lea. Blue Mountains, Sydney.

Roptoperus occidentalis, Lea. Perth.

Gygæus prodigus, Pasc. Kuranda.

Phlæoglymma pallida, sp. n.

Dark reddish brown, in places almost black ; antennæ and tarsi reddish. Densely clothed with white and with fawn-coloured scales.

Head rather convex, with very dense concealed punctures ; a shallow depression between eyes. *Rostrum* about the length of prothorax, not very wide, sides lightly incurved to middle ; punctures concealed behind antennæ, in front of same numerous and rather small, but larger on sides than along middle. *Scape* short, about the length of three following joints combined, inserted one-third from base of rostrum. *Prothorax* moderately transverse, base bisinuate and about twice the width of apex, which is bifasciculate ; with dense, round, concealed punctures. *Elytra* distinctly wider than prothorax, base trisinuate, shoulders rounded, sides parallel to apical fourth ; with rows of large, more or less concealed punctures ; third interstice subtuberculate near base. *Femora* stout, strongly dentate ; tibiæ angular or dentate near outer base, the middle pair more noticeably so than the others.

Length 6 mm.

Hab. W. Australia : Perth.

Intermediate in shape between *alternans* and *dorsalis*, but with very different clothing to that of either ; the eyes also are more pointed in front than in any previously described species. This, in the table* of allied genera, would refer the species to *Chimades*, but the mesosternal receptacle is not elevated above the metasternum as in that genus, the femoral dentition is stronger, and the tibiæ are different. Nevertheless, it may possibly be regarded as a link indicating that *Phlæoglymma* and *Chimades* should be united. The tibiæ are as described in *Europis*, but, as that genus was stated to differ from *Acalles* only in its tibiæ, whereas this species

* Proc. Linn. Soc. N. S. Wales, 1909, p. 59.

is widely separated from *Acalles* and its allies, it probably has little in common with *E. castanea*; certainly its clothing is very different. The type is evidently in perfect condition. On the prothorax the scales are mostly fawn-coloured, but with white scales forming a narrow median line, a sub-triangular line on each side extending from the base to near the middle, and an oblique line (not visible from above) on each flank. On the elytra the white scales clothe most of the surface. The fawn-coloured ones are more thickly compacted together (almost fasciculate), and form an oblique fascia from the middle of the second interstice to the seventh, in front of same is an irregular patch, extending from the second to the fifth, and more conspicuous about the base of the third than elsewhere; towards the apex there are a few feeble spots. The interstices are usually slightly elevated beneath the darker scales. On the under surface and legs the scales are almost entirely white; on the head the two colours are feebly mixed.

Phlæoglymma alternans, Pasc. Illawarra.

P. dorsalis, Pasc. Illawarra.

Austrectopsis oblongus, Lea. Kuranda.

Achopera lachrymosa, Pasc. Canning Ranges, Melbourne.

A. xanthorrhææ, Lea. Mundaring.

Pseudapries corticalis, Lea. Kuranda.

Ephrycus obliquus, Pasc. Kuranda.

Pseudometyrus tenuis, Lea. Illawarra.

Euthyrhynchus meditabundus, Fab. Kuranda.

Odosyllis crucigera, Pasc., var. *fuscotriangularis*, Lea.
Kuranda.

Metacymia marmorea, Pasc. Mundaring.

Hyperiosoma falcatum, Lea. Kuranda.

Camptorrhynchus dorsalis, Boi. Tweed River.

BARIDIIDÆ.

Baris apicinivea, sp. n. .

Black, highly polished. A thin stripe of white scales on each side of front of prothorax, a conspicuous spot on each side near apex of elytra, and some feeble spots at sides of eyes and of abdomen.

Head with numerous, small, clearly defined punctures. Rostrum long, strongly curved, somewhat gibbous, and thickened towards base; punctures dense and rather coarse on sides behind antennæ and about base, elsewhere small, becoming very small about apex. *Prothorax* lightly transverse, sides strongly rounded, apex about half the width of base; with rather sparse and small but sharply defined punctures. *Elytra* elongate-cordate; striation sharply defined; interstices impunctate. *Prosternum* scarcely depressed along middle in front. Pygidium minute. *Legs* rather long; femora minutely but acutely dentate.

Length $3\frac{1}{4}$ mm.

Hab. Queensland: Kuranda.

The tip of the pygidium is visible, so the species cannot be referred to *Gymnobaris*. Of the species of *Baris* previously tabulated by me, it differs from all having "Prothorax and elytra both with scales" by the elytra having no basal ones. In some lights the upper surface appears to have a vague bluish gloss. The subapical spot on each elytron of the type may be regarded as three close together (a moderately long one on eighth interstice, a transverse one on fourth to seventh interstices, and a very small spot on the third); but it is probably somewhat variable.

Baris bryanti, sp. n.

Black, not very shining. With a small feeble spot of white scales on scutellar lobe, and some still more feeble ones at sides of prothorax; elytra with some large scales on the odd interstices; rest of upper surface indistinctly clothed or glabrous. Legs and under surface moderately clothed.

Head with dense and rather small, but clearly defined punctures. Rostrum moderately long, not very stout, moderately curved; with dense punctures throughout, becoming linear in arrangement along middle; with a feeble median ridge and traces of others. *Prothorax* moderately transverse, with dense and fairly large punctures. *Elytra* very little wider than prothorax; striation narrow and deep; punctures of moderate size or rather small, and more or less regular, except at base and sides, where they are larger and more crowded. *Prosternum* moderately depressed along middle in front. Pygidium rather small. *Legs* rather short and stout; femora edentate.

Length $2\frac{3}{4}$ –3 mm.

Hab. Northern Territory: Darwin.

Very close to *sororia*, but elytra with a series of rather

large scales on each of the odd interstices. In some lights the elytra appear to have a vague purplish gloss.

Baris angophoræ, Lea. Blue Mountains, Illawarra, National Park.

B. devia, Lea. Kuranda.

B. sororia, Lea. Kuranda.

B. sublaminata, Lea. Kuranda.

Ipsichora desiderabilis, Lea. Kuranda.

CALANDRIDES.

Calandra oryzæ, Linn. Kuranda.

COSSONIDES.

Stereoborus brevirostris, sp. n.

Black, shining; tarsi and parts of antennæ of a dingy red.

Head wide, with sparse and minute punctures; interocular fovea scarcely larger than one of the adjacent punctures. *Rostrum* (excluding mandibles) about once and one-half as wide as long, its upper outline continuous with that of head, and with similar punctures; *scrobes* short and deep. *Scape* inserted fairly close to base of rostrum, somewhat curved, slightly longer than funicle and club combined. first joint of funicle not much wider than long, the others all strongly transverse; club briefly elliptic, the length of funicle. *Prothorax* very little longer than greatest width, rather suddenly dilated near base, subapical constriction continued across summit; punctures small and not very dense. *Scutellum* transverse, minute. *Elytra* cylindrical, the width of widest part of prothorax, apical fourth narrowed; with rows of fairly large rounded punctures, in narrow striæ; interstices with minute punctures, becoming somewhat larger posteriorly. *Under surface* with small punctures, even on prosternum. *Legs* stout, tibiæ each with a strong curved apical hook on one side of tarsus, a short spur on the other side.

Length $4\frac{1}{2}$ mm.

Hab. Queensland: Kuranda.

In general appearance like a small specimen of *Stereoderus macleayi*, but the considerably longer scape, very different front tibiæ, and absence of long tufts of hairs from the

mouth-parts, forbid its generic association with that species. It would probably have been treated as representing a new genus by the late Mr. Wollaston; but for the present I prefer to place it in *Stereoborus*, from all the Australian species of which it differs in its shorter rostrum and very minute punctures of head and prothorax.

Notiosomus rugosipennis, sp. n.

Black, somewhat shining; antennæ, tarsi, and tibial hooks of a dark dingy red.

Head almost impunctate at base; with rather small but clearly defined punctures, continued on to rostrum, but becoming somewhat smaller and denser there; interocular fovea very small. Rostrum almost parallel-sided, feebly dilated at insertion of antennæ, about as long as width of prothorax at base. *Prothorax* with sides rounded and dilated towards but not to base; with almost evenly distributed punctures, scarcely larger than those between eyes. *Elytra* not much wider than widest part of prothorax, parallel-sided to beyond the middle; with rows of deep punctures in narrow striæ; interstices wider than striæ, with small punctures and with numerous minute transverse impressions, giving the surface a rugose appearance, especially posteriorly.

Length 4-5 mm.

Hab. New South Wales: Sydney (G. E. Bryant and A. M. Lea), Illawarra (H. J. Carter).

In general appearance close to *congener*, but with smaller punctures and median impunctate line on prothorax scarcely traceable; *major* is a larger species, with much coarser punctures; *australis* is unknown to me, but is described as having the under surface with deep and coarse punctures, which the present species certainly has not. On some specimens the interocular fovea appears to be no larger than some of the surrounding punctures. The rostrum is about the same length on both sexes, but is considerably wider on the male than on the female, so that its length is scarcely more than twice its width, on the female the length is about thrice the width. The male also has a shallow depression along the two basal segments of abdomen.

Cossonus nitidirostris, sp. n.

Black, shining; basal third of elytra (except suture and margins) of a bright castaneous, tibial claws, tarsi, and antennæ of a more or less dingy red; parts of under surface obscurely diluted with red.

Head with clearly defined punctures, smaller about base than elsewhere; with a small, isolated, interocular fovea. Rostrum twice as long as greatest width, which is in front of antennæ, from antennæ to base decreasing in width, and with punctures as on head, in front very shining and with small and sparse punctures. *Prothorax* very flat, base lightly bisinuate and twice the width of apex, which is somewhat elevated in middle; sides strongly rounded at apex, gently elsewhere, with numerous, distinct, non-confluent punctures, of moderate size in middle, and small towards sides; with a feeble impunctate space along middle. *Elytra* not much, but distinctly wider than prothorax, sides feebly decreasing in width almost from base; with rows of fairly large round punctures, in shallow striæ, becoming smaller posteriorly, but the striæ deeper; interstices wider than striæ, each with a row of sparse minute punctures.

Length (excluding rostrum) $4\frac{1}{4}$ mm.

Hab. Queensland: Kuranda.

In general appearance fairly close to *indigenus*, but much more depressed, punctures much smaller, rostrum narrower and more shining, interocular fovea much smaller, &c. The description of *albertisi* is rather unsatisfactory, but its prothoracic punctures are evidently different to those of this species, as Pascoe says of them, in comparison with those of *basalis*, "magis sed irregulariter." Those of *basalis* being "in medio et lateribus extus grosse." *Albertisi* also has apparently more of the elytra pale, and the two colours less sharply defined than in the present species.

Dryophthorus corticalis, Payk. Kuranda.

Pentamimus rhyncholiformis, Woll. Cannington.

POSITION DOUBTFUL.

MESEMBRINOCIS, gen. nov.

Head of moderate size, partly concealed from above. Eyes rather large, round, coarsely faceted, not close together. Rostrum slightly longer than prothorax, rather wide, subparallel-sided, lightly curved. Scrobes narrow, deep, oblique, open posteriorly, and extending almost to lower edge of eyes. Antennæ moderately thin, inserted about one-third from apex of rostrum; scape almost straight, slightly shorter than funicle and club combined; first joint of funicle long, second moderately long, the others short; club elliptic-ovate, almost the length of funicle. *Prothorax* lightly

transverse, base gently rounded, without ocular lobes. *Scutellum* distinct. *Elytra* short, briefly oblong-cordate, much wider than prothorax. *Metasternum* moderately long. Abdomen with the median segments drawn slightly backwards at sides. *Legs* short; front coxæ touching; femora stout, strongly dentate; tibiæ stout, dilated at apex, with a small terminal mucro; tarsi rather stout, third joint wide and deeply bilobed, claws appendiculate.

I am unable to assign this genus with confidence to any subfamily. The species in appearance is not unlike a *Gerynassa* of the Eirrhinides, but the claws are not simple; when they can be clearly viewed each is seen to have a large basal appendix, that is abruptly truncated at about one-third from the apex, with a distinct notch between it and the apex of the claw proper. This, however, can only be seen when the claws are viewed from below, from any other direction they appear to be simple. The pygidium is not exposed, and although this is regarded as of secondary importance in the Tychiides and Anthonomides, other characters are divergent—for instance, in the Anthonomides the rostrum is described * as “long, slender, and cylindrical” and the eyes as “small and distant from the prothorax.” In the Tychiides the abdomen is said to have its median sutures strongly angulated at the sides; in the present genus they are but feebly angulated there and several genera of Eirrhinides have these sutures very similar; this character, however, is certainly variable in the Tychiides. The Prionomerides are stated to have the ventral sutures (other than those of the first segment) strongly angulated at the sides and the pygidium exposed.

The fact is that the various classifications of the Curculionidæ have been made without making sufficient allowance for Australian ones, and when our species are better known will need considerable modification. For the present it seems as well to refer this genus, and a few others, to the end to a cluster of genera with the heading “Position Doubtful.”

Mesembrinocis variegatus, sp. n.

Dark reddish brown, in places almost black; antennæ, tibiæ, and tarsi reddish. Densely clothed with fairly stout scales, varying from almost white to sooty.

Head with dense concealed punctures. Rostrum with narrow carinæ separating rows of punctures to antennæ, but

* Leconte and Horn's ‘Classification of the Rhynchophora.’

partially concealed about base, in front of antennæ with subconfluent punctures. *Prothorax* not much longer than wide, sides slightly rounded from base to apical third, and then decreasing to apex, which is about two-thirds the width of base; with dense concealed punctures. *Elytra* about one-third wider than prothorax, and not thrice as long, about one-third longer than wide; striate-punctate, but punctures normally concealed; interstices gently convex, with numerous concealed punctures.

Length (excluding rostrum) 4 mm.

Hab. New South Wales: Illawarra.

On the head and basal half of rostrum the scales are mostly ochreous, with a few paler spots. On the prothorax they are mostly ochreous brown or sooty, with a pale oblique stripe on each side, and a less distinct one along the middle. On the scutellum they are white. On the elytra they are mostly of a dingy brown, but on the apical fourth they are of a rather pale ochreous, bounded anteriorly by a curved sooty line, across the middle there are some whitish spots, accentuating some sooty ones, and on the shoulders and near the scutellum there are also some whitish and sooty spots. The whitish spots from some directions appear like feeble fascicles. On the under surface the scales are almost white, and on the legs they are mostly stramineous. The type is probably a male.

XL.—*New Oriental Pentatomoidea.*

By E. BERGROTH, C.M.Z.S.

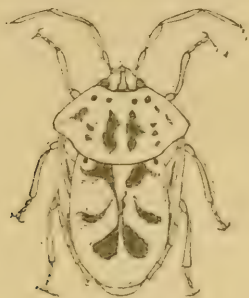
Fam. *Scutelleridæ.*

Coleotichus ornamentifer, sp. n.

Rather broadly obovate, shining. Head a little less than half the length of pronotum, not quite one-half broader than long, almost impunctate, laterally a little sinuated somewhat before the eyes, clypeus slightly passing apex of juga, a little constricted in the middle, posteriorly reaching slightly beyond the level of the middle of the eyes; ocelli a little over three times more apart from each other than from eyes, placed immediately behind the level of the posterior margins of the eyes; inferior margin of bucculæ slightly sinuated, first and second joints of antennæ equal in length, third one-half longer than second, fourth somewhat shorter than second

and third together, fifth as long as fourth; rostrum not quite reaching posterior end of metasternum, the last three joints subequal in length. Pronotum one-half broader than long, within the slightly rounded and bluntly subelevated antero-lateral margins with a distinct, rather broad, subangular or a little curved longitudinal impression, the anterior half of which is almost parallel to the margins and extended from the apical angles to near the middle of the margins, whilst the posterior half is parallel to the longitudinal axis of the body; sparsely punctured, lateral borders and cicatricial areas very remotely so, a longitudinal anteriorly slightly raised, posteriorly evanescent median line impunctate; apical margin moderately sinuate, obliquely truncate behind the eyes, lateral angles rounded, very slightly prominent, postero-lateral margins a little sinuate. Scutellum reaching apex of abdomen, slightly widening from the base to a little beyond it, then subparallel as far as to the middle of the fourth connexival segment, then arcuately narrowing to the broadly and slightly rounded apex, sparsely punctured, somewhat more thickly and finely so in the apical fourth; a transverse posteriorly rounded basal area not quite reaching the lateral margins very remotely punctured and in the middle impunctate, a slightly raised impunctate median line running from the posterior margin of the basal area backwards, but evanescent before apex. Pectus sparingly and very irregularly punctate, anterior flaps of prosternum shaped as in the other species of the subgenus *Paracoleotichus*, strongly punctured at their base, almost impunctate toward their apical margin. Hemelytra slightly passing apex of scutellum and abdomen; corium not quite reaching apex of fourth connexival segment; exocorium remotely and extremely finely punctulate, mesocorium and especially endocorium much more strongly (though sparingly) punctured, suture between exocorium and mesocorium three times longer than that between mesocorium and endocorium. Abdomen beneath rather irregularly strigose, but scarcely punctured, the middle of the disk and the lateral borders smooth, the longitudinal median groove very distinct from base of venter to apex of fifth segment, narrower and less distinct in basal third of sixth segment, the apical angles of the segments a little prominent, those of the sixth segment more acute and tooth-like; sixth female ventral segment in the middle a little longer than the two preceding segments together, and twice longer than its lateral margin (including the apical tooth), its apical margin broadly bisinuate, the median apical part of the segment and the female genital segment with a

pale suberect pilosity, the median female genital lobes nearly twice broader than long at their interior margin, but not reaching lateral angles of basal lobes, apical lobes arcuately triangular, acute at apex. Colour argillaceous, juga and lateral borders of prothorax, of corium, and of abdomen reddish orange, lateral margins of clypeus, a median basal fascia to head emitting two vittæ to base of clypeus, four rounded spots placed transversely in anterior part of pronotum (one at each end of cicatrices), two longitudinal bands near middle of posterior portion of pronotum, three or four spots between these bands and the lateral margins, a basal spot to scutellum on each side not far from the angles, a large scutellar marking resembling a written \propto with the



end of the branches strongly dilated, a curved abbreviated fascia on each side of the \propto -shaped marking, a sublateral vitta to pleuræ, a broad anteriorly abbreviated vitta to meso-corium, an interior apical vitta to exocorium, the apical angles of the abdominal segments, the transverse sublateral impression behind the spiracles, and a median spot to sixth ventral segment black; basal area of scutellum (except the black markings) pale yellow; membrane fuscous; all punctures of the argillaceous parts of pronotum and scutellum placed in a small round semipellucid spot of a peculiar watery dark greyish colour not unlike that of diluted ink; antennæ piceous, first joint, apical half of second, and basal half of third joint testaceous; rostrum, except first joint, black; legs dark testaceous, femora more or less suffused with fuscous.

Length, ♀ 14 mm., width 8.5 mm.

Borneo: Santubong in Sarawak (*J. C. Moulton*),

Allied to *C. artensis*, Montr., but differing in the very much less punctured basal area of scutellum, longer sixth ventral segment, and several other details. The colouring is probably variable as in the other species of the genus, but in the

colour-markings of the scutellum none of the numerous varieties of *artensis* seems to be similar to the single known specimen of the Bornean species.

The species of *Coleotichus* principally inhabit the islands of the Pacific Ocean. One species is known from Sumatra, but none had previously been found in any of the other great Sunda islands.

Fam. Pentatomidæ.

Subfam. *ARMINÆ*.

Schouteden has divided *Canthecona*, Am. S., into two genera, separating the Asiatic species as a distinct genus, *Cantheconidea*. The latter genus he divides into two sections, A and B, corresponding to Stål's division *aa* and *aaa* of *Canthecona*. These sections differ much more *inter se* than the section B of *Cantheconidea* differs from *Canthecona*, and must in my opinion be regarded as distinct genera with the following characters :—

The sides of the metasternum strongly carinately raised above the level of the coxæ, freely produced forward and backward between the coxæ. Tibiæ cylindrical, only toward the apex flattened or slightly sulcate. The males with no sericeous patches on the venter; apical margin of sixth male ventral segment broadly bisinuate. (Type: *C. javana*, Dall.).....

Cantheconidea, Schout.

The sides of the metasternum a little raised, but not produced forward and backward. Tibiæ conspicuously sulcate down their whole length. The males with a large sericeous (stridulatory?) patch on each side of the venter extended through the fourth and fifth segments; apical margin of sixth male ventral segment broadly unisinate. (Type: *C. furcillata*, Wolff)

Eocanthecona, gen. nov.

Asopus chrysopterus, H. Sch., from the island of Guam, has remained unknown to later authors, but has in all catalogues been placed in *Canthecona*, and later in *Cantheconidea*; yet from the description and figures, and from the fact that Herrich-Schäffer placed it in a division characterized by "Vorderschenkel ohne Dorn," it is clear that it has nothing to do with this group of genera. There can be little doubt that it belongs to an undescribed genus.

Eocanthecona eburnea, sp. n.

Ivory-white, lateral margins of juga, upper part of antenniferous tubercles, a spot on each side of vertex enclosing the ocellus, a transverse pronotal spot outside each cicatrical area inwardly continued round this area, a subquadrate spot on the connexival incisures, an irregular spot on propleura and mesopleura, mesosternum (except the median ridge), posterior margin of orificial sulcus, a narrow curved sublateral fascia to metapleura emitting a short branch to the lateral margin, a spot at base of epipleura, a short transverse sublateral streak on second ventral segment, a narrow curved sublateral fascia on the last four ventral segments connecting the basal margins with a point a little behind the spiracles, a spot at basal angles of third ventral segment, and a median spot on sixth ventral segment, shortly continued over the fifth, brassy greenish black; humeral processes of prothorax, a deep triangular fovea at basal angles of scutellum, dorsum of abdomen, and a median vitta to female genital segment piceous; membrane fuscous, an oblong spot on each side before the apex hyaline. Head above sparsely punctured with fuscous, an oblique oblong area at anterior part of eyes impunctate, first three joints of antennæ testaceous, apex of third broadly fuscous, last two joints fuscous black with a broad basal ochraceous annulation, second, third, and fifth joints subequal in length, fourth a little longer, rostrum ivory-white, last joint castaneous. Pronotum, scutellum, corium, and connexivum smooth and impunctate, with the following exceptions: pronotum with some punctures between the cicatrical areas and the apical margin, a row of punctures immediately within the lateral margins, and numerous partly thick-set punctures which form a fascia connecting the humeral processes and emitting from its middle an irregular continuation forward to a little beyond the middle of the pronotum; scutellum with scattered punctures arranged in a triangular basal area and an oblong area on each side near apex of frena; exocorium with a row of punctures reaching from the base to beyond the middle, then irregularly sparsely punctate, mesocorium with an oblong punctured area behind the middle near the radial vein, sparsely punctate in its outer apical area, and at the inner margin with a row of punctures duplicated behind the middle, endocorium behind the middle with a row of punctures; connexivum with a few strongly impressed points in the greenish-black incisural spots, except the hindmost; the puncturation of pronotum, scutellum, and corium fuscous,

coarse on pronotum, somewhat finer on scutellum, and still finer on corium. Prothorax with the antero-lateral margins sinuate behind the middle, slightly rounded and distinctly crenulated between the sinuosity and the apical angle, humeral processes directed outward and a little forward, their posterior margin with a blunt tooth at some distance from the acute apex. Hemelytra passing apex of abdomen by about one-third the length of the membrane, apical margin of corium somewhat rounded. Pleuræ strongly and sparsely punctured with greenish black and fuscous, lateral and posterior borders of metapleuræ impunctate. Abdomen with the apical angles of the segments a little prominent, venter finely and remotely punctulate with ferruginous, spiracles pale brownish. Legs ivory-white, femora dotted with reddish brown, apex of femora and of tibiæ, and base of tibiæ mottled with greenish black or fuscous, tarsi more or less infuscated; fore tibiæ a little dilated at apex.

Length (excl. membrane), ♀, 12 mm.

Philippine Islands: Mount Makiling, Luzon (*C. F. Baker*).

In some specimens the punctures between the cicatrical areas and the apical margin of the pronotum, the row of punctures within the pronotal lateral margins, and the puncturation on the outer half of the pleuræ are lacking.

Very remarkable by having the pronotum, scutellum, and corium for the most part quite smooth and impunctate, and in this character differing from all previously known species.

Subfam. *PHYLLOCEPHALINÆ*.

UDDMANIA, gen. nov.

Body oblong, depressed. Head small, a little broader than long, rather strongly sinuated before the large prominent globose eyes, vertex convex, ocelli wide apart, placed near the eyes, clypeus somewhat bent down in its apical part, juga a little longer than clypeus, but neither meeting nor convergent in front of it, rounded exteriorly before apex, antenniferous tubercles blunt at apex, the greater part of them visible from above, bucculæ very strongly elevated, a little higher behind than before, seen from the side rounded at anterior end, vertical at posterior end, their inferior margin straight, rostrum reaching anterior coxæ, its second joint almost reaching posterior end of bucculæ, antennæ slender, first joint somewhat incrassated, passing apex of head by about half its length, the three following joints

subequal in length, each much longer than first (last joint wanting). Pronotum rather deeply arcuately sinuate at apex, antero-lateral margins deeply obtusangularly sinuated in the middle, owing to the humeral angles being produced in a subtriangular process directed obliquely forward and outward, these margins subacute, irregularly denticulated from pronotal apical angles to base of humeral processes, these processes not reaching the level of the pronotal apical angles, their margins entire, not toothed, pronotal basal margin straight. Scutellum longer than broad, about reaching middle of abdomen, laterally sinuated considerably behind the middle, postfrenal part narrow, nearly twice as long as broad, its sides subparallel, apex rounded. Mesosternum somewhat convex, keeled in the middle. Orificial sulcus rather short. Hemelytra when closed scarcely broader than, but entirely covering, the abdomen, corium much longer than scutellum, costal margin slightly rounded, apical angle acute, apical margin straight, rimula through a little less than its basal half closely following the radial vein, then somewhat deviating from it, ending not far behind middle of corium, membrane with the veins forked, the outermost and the three interior ones simple. Abdomen laterally slightly rounded, ventral lateral border a little concave, apical angles of the segments scarcely prominent, those of the last segment (♂) broadly lobately rounded, spiracles obliquely transverse, placed in the posterior declivity of a small callus, more remote from the lateral than from the apical margin of the segments. Legs rather slender, fore tibiæ beneath with a small indentation in the apical half preceded by a short spinule, first joint of all tarsi very slightly longer than the two others together, and more robust.

This genus is allied to *Cressona*, Dall., from which it differs in several details in the structure of the head, the much shorter, more divergent, and not serrate humeral processes of the prothorax, &c.

Named in memory of the first Finnish entomologist, Isaac Uddman, whose illustrated dissertation 'Novæ insectorum species' (Aboæ, 1753), contains for that time very good descriptions of a hundred species, later specifically named by Linnæus and others.

Uddmania vepallida, sp. n.

Dull, above pale ochraceous, finely and dispersedly punctured with blackish and fuscous, still more finely and remotely

so on head and corium, beneath still paler than above, rather sparsely but less finely punctured with black; a narrow median vitta running from apex of pronotum to apex of scutellum, a percurrent pleural vitta, a broad ventral vitta on each side near the middle, and a rather large oval sub-lateral area to each ventral segment impunctate, the ventral vittæ, however, with sundry black points arranged in an indefinite and irregular longitudinal row, venter at the median basal part and on each side near the median line here and there tinted with ferruginous or sanguineous; antenniferous tubercles above, antero-lateral margins of pronotum from apical angles to base of humeral process (including the teeth), and a small oblong spot behind middle of corium at apex of rimula black; membrane pellucid, with scattered round and shortly linear fuscous-black specks. Head one-fifth broader than long, jugs finely obliquely wrinkled and with the scanty puncturation very pale brown. Pronotum feebly transversely rugose, humeral processes slightly shorter than their basal breadth, their anterior margin rounded toward the apex, their posterior margin straight, a little longer than the part of the postero-lateral margin lying before the base of corium. Scutellum feebly transversely rugose. Hemelytra (♂) slightly passing apex of abdomen, corium reaching somewhat beyond base of penultimate connexival segment. Abdomen with blackish spiracles, sixth male ventral segment in the middle slightly shorter than fifth, male genital segment not quite reaching the apex of the lateral apical lobes of the last ventral segment, its apical margin obtusangularly sinuated in the middle. Legs very remotely and finely dotted with brown.

Length, ♂, 19 mm.

Philippine Islands: Mt. Makiling, Luzon (C. F. Baker).

Tetroda denticulifera, sp. n.

Brownish ochraceous, thickly and finely concolorously punctulate, less thickly and more superficially punctate on the venter, scutellum at the sides from basal angles to apex of frena with a dark fuscous posteriorly tapering stripe, and immediately inside this with a transversely rugose whitish vitta which, behind the frena, occupies the lateral margins themselves, tapering posteriorly but almost reaching apex, membrane greyish hyaline with pale brown veins, venter with a whitish callus immediately before each spiracle. Head about one-third longer than broad, the lateral margins with a short acute spine a little in front of the eyes, jugs

directed straight forward, lanceolate, very narrowly rounded at apex, their freely projecting part as long as the distance between the apex of clypeus and a line connecting the ocelli, and as broad at its base as half the distance between the ocelli. Pronotum with a low laterally evanescent ridge between the humeral angles, and between this and the cicatrical areas with a few transverse rugæ, the apical processes slightly passing the level of the apex of the clypeus. Hemelytra (♀) somewhat passing base of dorsal genital segment, corium not quite reaching apex of antepenultimate connexival segment, its apical margin slightly rounded. Abdomen in the interior half of the largely exposed connexivum with numerous short, sublevigate, vermicularly tortuous, impressed, fuscous lines arranged in a longitudinal band; beneath on each side a little within the lateral margins with a longitudinal band, and somewhat more inwardly at the apical margin of the segments (except the sixth) with a transverse fascia, all composed of similar meandering lines; female dorsal genital segment somewhat broader than head, its apical margin broadly and slightly sinuate.

Length, ♀, 17 mm.

Tonkin.

In having a small acute lateral spine a little in front of the eyes this species is allied to *T. obtusa*, Dall., but the jugs are narrower and less rounded at apex, the anteocular spines are concolorous with the head, the scutellum is quite differently coloured, and the venter is less thickly and less strongly punctured without the large transverse impunctate lateral foveæ so characteristic of *obtusa*.

Subfam. ACANTHOSTOMATINÆ.

Proctophantasta minax, sp. n.

Shortly oval, above black; head with the lateral margins from within the eyes to beyond middle of jugs, a longitudinal band on jugs, a line in the apical half of clypeus, a spot inside each eye, an elongate lanceolate spot reaching from base of clypeus to base of head, and two transverse basal spots on each side yellow; pronotum with the antero-lateral and postero-lateral margins, seven spots (the median one larger and subquadrate) on the transverse elevated subapical area, and five spots immediately behind the impressed line posteriorly terminating that area stramineous, the two outer ones (on each side) of the latter spots oblique and removed from the oblong, somewhat callose median spot; scutellum

with a spot near the basal angles and a large transversely oval blotch almost reaching the lateral margins immediately behind the middle yellow; corium with the basal part of the costal margin yellow, and with an elongate triangular whitish area in the basal half of the mesocorium; connexivum with a yellow spot at the apical angles of the four first segments, fifth and sixth segments entirely stramineous, except their black apical spines; membrane hyaline, shaded with fuscous toward base; head beneath and pectus stramineous, the former with a narrow fuscous streak before the antenniferous tubercles, middle part of all sterna (except median keel of mesosternum), three longitudinal bands on propleuræ, the outermost and innermost of which are transversely continued inwards from both their ends, a transverse angular fascia in anterior part of mesopleuræ together with their whole exterior and posterior parts, and the metapleuræ (except orificia, posterior border, and posterior half of lateral border) fuscous black; venter piceous brown, a yellow spot at apical angles of the first four segments, lateral borders of fifth segment, the whole sixth segment, and the male genital segment stramineous; antennæ fuscous, first and second joints (except outer and inner margins of first), and the extreme base of the following joints dark testaceous; rostrum stramineous, last joint fuscous black; legs fuscous, femora (except the dusky apex) dark fulvous with a rusty tint, toward the base, together with trochanters and coxæ, whitish, a spot on coxæ fuscous. Head impunctate, but with an impressed punctured longitudinal line on each side of vertex before the ocelli, which are a little more remote from each other than from the eyes, first joint of antennæ passing apex of head by one-third its length, second joint a little shorter than third which is at least one-fifth shorter than fourth (fifth wanting), rostrum reaching apical margin of third ventral segment. Pronotum strongly and rather thickly punctured, the elevated subapical area and the pale spots behind it smooth, lateral margins straight. Scutellum coarsely and rather thickly punctate, postfrenal part more finely punctured, the pale areas impunctate, lateral margins straight. Pectus impunctate, a transverse row of fuscous punctures near apical margin of prosternum, posterior part of propleuræ finely and remotely punctate with fuscous, median keel of mesosternum low and very narrow, slightly dilated anteriorly between the fore coxæ. Hemelytra passing apex of genital segment by about one-fourth the length of the membrane, corium as thickly punctured as the scutellum but less strongly so, mesocorium in its interior part with three regular rows of

punctures, the outer two rows somewhat curved behind the middle, exterior part of mesocorium and apical part of exocorium remotely punctate. Abdomen impunctate, beneath bluntly roof-shaped in the male, sixth male ventral segment in the middle somewhat longer than fifth, its apical spines rather strongly arcuately upturned from base to apex, almost sickle-shaped, passing apex of membrane, male genital segment subtriangular, almost as long as the last two ventral segments together.

Length (excl. membrane and anal spines), ♂, 6.8 mm.

Philippine Islands: Mount Banahao, Luzon. (*C. F. Baker*).

In the colour-pattern of the upper side similar to *P. satanas*, Bredd., but the second antennal joint is much shorter, the pronotum more strongly and regularly punctate, the yellow submedian area of the scutellum not punctured in the middle, the anal spines are more curved and upturned, and the underside of the body and the legs somewhat differently coloured.

Proctophantasta minitabundus, sp. n.

Shortly oval, pale testaceous with the following piceous markings: interior margin to juga, a narrow sublateral vitta to juga anteriorly occupying the margin itself and posteriorly widening into a spot inside anterior part of eyes, two somewhat outwardly curved vittæ on vertex, a spot between ocelli and eyes, upper side of antenniferous tubercles and a streak before them, apical border of pronotum, a band inside its antero-lateral and postero-lateral margins, an irregular transverse fascia, interiorly widening and enclosing a fulvous spot, on each side of the transversely elevated pronotal subapical area, the transverse linear impression posteriorly terminating this area, an oblique vitta not far from the posterior part of the pronotal antero-lateral margins and parallel to them, reaching the postapical transverse callosity, a spot behind middle of corium, its interior and apical margins and the apical half of the costal margin, three vittæ on propleuræ quite similar to those of *P. minax*, middle part of mesosternum (except median keel), a spot at base of middle acetabula, a short vitta close to exterior margin of mesopleuræ, anterior, exterior, and posterior margin of the evaporative area, and an abbreviated transverse fascia a little within the lateral margins of the ventral segments; connexivum black, each segment at the interior margin with two rectangular fulvous spots, one near base, the other at apex, and at the exterior

margin with an elongate triangular fulvous spot reaching from apex to beyond middle; membrane hyaline; ventral segments with a pale yellow spot at the apical angles; antennæ with the first two joints testaceous, the basal one with a fuscous streak on each side, the last three joints fuscous black, with the base testaceous; rostrum and legs pale testaceous, the former with the last joint fuscous. Head impunctate, but with an impressed punctate area at the exterior base of the juga and an impressed punctured longitudinal line on each side of vertex before the ocelli, which are as remote from the eyes as from each other, antennæ as long as the body without the anal spines, first joint distinctly passing apex of head, second as long as third which is a little shorter than fourth and conspicuously longer than fifth, rostrum reaching apical margin of third ventral segment. Pronotum, except the smooth transverse elevated subapical area, strongly but very irregularly punctate, the whole posterior part (behind the elevated transverse area) with an anteriorly widened median line, an oblique sublateral vitta, a rounded spot inside this, and some smaller anterior spots and waved transverse lines impunctate, pronotal lateral margins straight. Scutellum coarsely punctate, postfrenal part finely punctulate, a small callus at the basal angles, a percurrent median line, and the apex impunctate, the lateral margins slightly sinuate at apex of frena. Pectus impunctate, a transverse row of fuscous punctures near apical margin of prosternum, posterior part of propleuræ remotely punctured with fuscous, median keel of mesosternum low and very narrow. Hemelytra passing apex of genital segment by nearly one-third the length of the membrane, corium strongly punctured, mesocorium in the basal half of its exterior border impunctate. Abdomen impunctate, beneath in the female rather deeply and broadly longitudinally sulcate down the middle, the furrow narrower and less deep in the sixth segment, at the base of which it is narrowly interrupted, apical spinelets of fifth segment somewhat curved, apical spines of sixth segment a little longer than genital segment and last ventral segment taken together, passing apex of membrane, directed straight backwards, but curved a little outward at the base and a little upward at the apex.

Length (excl. membrane and anal spines), ♀, 7.5 mm.

Philippine Islands: Mt. Banahao, Luzon (*C. F. Baker*).

More nearly related to *P. colax*, Bredd., than to any other known species, but very distinct in several characters.

To Breddin's very good generic description I have only to add that the evaporative area is large, transversely oval,

occupying the greatest part of the metapleura, and very slightly sculptured. Distant (Rhynch. Brit. Ind. iv. p. 464) has also described the genus (under the wrong name "*Protophantasta*") and says in the description: "tibiæ longitudinally grooved." Should the tibiæ really prove to be sulcated in the species described by Distant, this would be a most unusual and aberrant specific character of that species, as the cylindrical non-sulcate tibiæ is one of the principal characters of the Acanthosomatinae. I have seen no member of this sub-family with furrowed tibiæ.

Five species of this curious genus were previously known, one from Ceylon, two from Sumatra, one from Java, and one from Borneo.

XLI.—Notes on the Genus *Nyctophilus*.

By OLDFIELD THOMAS.

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WHEN describing the new genus *Pharotis* last year I published * a cursory survey of its ally, *Nyctophilus*, and finding out in what direction further material was most urgently needed, I made an appeal to the authorities of the Australian Museum, Sydney, for specimens from Eastern Australia.

Through the kindness of Mr. A. R. McCulloch, that appeal has been most liberally responded to, and I have been entrusted with their whole collection of the genus, numbering no less than 42 specimens from various localities, all preserved in spirit, thus supplementing the British Museum material, which is largely in skin.

On studying these spirit-specimens I find that most useful differential characters may be drawn both from the development of the nose-leaf, hitherto supposed to be the same throughout the genus, and from the structure of the bone to which I have recently drawn attention in squirrels, the baculum or penis-bone.

The facial membranes consist, firstly, of a definite semi-circular leaf surmounting the nostrils, with or without a median notch in its upper edge, and, secondly, of a rounded elevation behind it, more or less divided centrally into two halves, and varying in its development in three different degrees, which may be briefly described as follows:—

1. Elevation quite low, rounded, nearly uniformly hairy, division into two scarcely perceptible.

* Ann. & Mag. N. H. (8) xiv. p. 383.

2. Higher, divided in the centre by a notch, the median line of which tends to be grooved, naked, and of a different texture to the rest*.

3. Much higher, the two divisions connected with each other, and surpassed above, by a median, smooth, and naked membrane, which is folded to form a Y-shaped groove on its anterior surface†.

There is, however, a nearly complete continuity of development from one extreme to the other, so that the position of individual specimens may occasionally be in doubt.

The baculum in *Nyctophilus* has a broad stout bifid base and a downwardly curved shaft, generally about $2\frac{1}{2}$ –3 times the length of the breadth of the base. Its tip may be either simple and slightly flattened, or bifurcate.

The species are here taken geographically, beginning with the west and passing first eastwards and then to the north and north-west.

1. *Nyctophilus major*, Peters.

Abh. Ak. Berl. 1860, p. 125 (1861), ex Gray, Voy. Ereb. Terr. pl. xxi. fig. 2 (plates prepared in 1845, not published till 1875).

Size largest of the genus, a skull measuring 19·8 mm. in greatest length; maxillary tooth-row 7·3. Bullæ fairly large, 4·3 mm.

No spirit-specimens available, but the nose-leaf appears from skins to be of the less-developed type. No bacula seen.

Hab. Western Australia. Type from Perth. Other specimens from King George's Sound, Southern Cross, &c.

Type. B.M. no. 44.7.9.20.

2. *Nyctophilus geoffroyi*, Leach.

Trans. Linn. Soc. xiii. p. 78 (1822).

N. australis, Peters, Abh. Ak. Berl. 1860, p. 123, plate (1861).

Size small or medium. Ears proportionally large. Nose-leaf of the most highly developed type, as described under 3, above. Baculum with the normal broad bifid base and simple slightly flattened tip. Bullæ large.

Three subspecies may be recognized:—

* Dobson's figure (Catalogue, pl. xi. fig. 7) corresponds to this degree of development, but is slightly exaggerated towards the third type.

† Peters's figure of *Nyctophilus australis* (Abh. Ak. Berl. 1860, plate, fig. 2) shows this leaf, but does not indicate the Y-shaped groove seen in the best-developed specimens.

a. *N. geoffroyi geoffroyi*.

Synonymy as above.

Size smaller, a skull 14 mm. in condyle-basal length, maxillary tooth-row 5.5. Bulla 4.0. Colour rather dark.

Hab. West Australia. Type-locality, as identified by Tomes *, Albany, King George's Sound.

b. *N. geoffroyi pallescens*, Thos.

Ann. & Mag. N. H. (8) p. 79 (1913).

Like true *geoffroyi*, but colour much paler. Skull: greatest length 15.3 mm.; maxillary tooth-row 5.7; bulla 3.8.

Hab. Arid central region of Australia. Type-locality, Alexandria, Northern Territory. Other specimens from Lake Eyre, S. Australia, and Normanton, N.W. Queensland.

Type. B.M. no. 7.1.4.1.

c. *N. geoffroyi pacificus*, Gray.

Barbastellus pacificus, Gray, Zool. Misc. p. 8 (1831) ("Islands of the Pacific").

Nyctophilus unicolor, Tomes, P. Z. S. 1858, p. 33 (Tasmania).

Averaging rather larger than true *geoffroyi*. Type-skull 15.8 mm. in greatest length; maxillary tooth-row 5.5; bulla 3.8. Colour dark.

Hab. S.E. Australia and Tasmania. Exact locality of type not known, but a specimen from Gippsland agrees closely with it. A well-preserved series from Mt. Kosciusko in the Australian Museum.

Type in the British Museum.—Old Collection.

3. *Nyctophilus sherrini*, sp. n.

Size large, only slightly less than in *N. major*. Ears of medium size for the genus. Colour faded in the only specimen available. Nose-leaf of a little-developed type, between Nos. 1 and 2, therefore contrasting with the other Tasmanian species, *N. geoffroyi (pacificus)*, which has a No. 3 nose-leaf. Baculum slender, the shaft but little curved, narrow and high in section, tapering terminally to a fine point.

Skull shorter than that of *N. major*, the brain-case higher and more rounded. Sagittal crest well developed. Tooth-row decidedly shorter than in *N. major*.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 45 mm.

* Cf. P. Z. S. 1906, p. 470. Specimen now B.M. no. 7.1.1.338.

Head and body 55; tail 45; ear 26×17.5 ; third finger, metacarpal 40, first phalanx 16; lower leg and hind foot (c. u.) 28.3. Baculum 4.4.

Skull: greatest length 18.5; condylo-basal length 17.2; zygomatic breadth 11.4; palato-sinual length 7.1; bulla 4.2; maxillary tooth-row 6.9.

Hab. Tasmania.

Type. Adult male in spirit. B.M. no. 52.1.15.50. Collected and presented by Mr. Ronald Gunn.

This fine species is evidently most nearly related to the West Australian *N. major*, but has a smaller and differently shaped skull and shorter tooth-row. It is far larger than the other Tasmanian form, *N. geoffroyi pacificus*, of which *Tomes's N. unicolor* is a synonym.

It is named in honour of Mr. W. R. Sherrin, to whom every mammalogist who has visited the Museum is indebted for assistance, and whose admirable preparation of tiny skulls and tinier bacula has so immensely helped in the mammalian work done both by staff and visitors.

4. *Nyctophilus gouldi*, Tomes.

P. Z. S. 1858, p. 31.

Size rather large. Ears large. Nose-leaf of middle development, as 2 above. Baculum stout, little curved, thick for its basal portion, then abruptly narrowing in its terminal third to a long point. Bullæ larger.

Skull of an adult male from Sydney—greatest length 17.7 mm.; maxillary tooth-row 6.4; bulla 4.2.

Hab. New South Wales and South Queensland. Type-locality, Moreton Bay. Specimens examined from the Blue Mountains and Sydney northwards to Gin Gin, near Bundaberg, Queensland, 25° S. lat.

Type. B.M. no. 7.1.1.339.

5. *Nyctophilus bifax*, sp. n.

Size fairly large. Ears decidedly smaller than in *N. gouldi*. Colour medium, a fresh skin cinnamon-brown above, little paler below. Nose-leaf of the least degree of development, No. 1, above. Skull strongly built, with well-developed ridges; bullæ smaller than in *N. gouldi*. Baculum stout, scarcely tapering for its basal half, then narrowing slightly to the tip, which is distinctly bifurcate, the prongs parallel, separated by a semicircular concavity corresponding to the flattened end in other species.

Dimensions of the type (in spirit) :—

Forearm 41 mm. (range 40–43).

Head and body 54 ; tail 43 ; ear 23.5×15 ; third finger, metacarpus 38, first phalanx 15.5 ; lower leg and hind foot (c. n.) 27.5. Baculum 3.2.

Skull : greatest length 17.7 ; condylo-basal length 15.8 ; zygomatic breadth 10.6 ; palato-sinual length 6.5 ; maxillary tooth-row 6.5 ; bulla 3.7.

Hab. North Queensland, within the tropics. Type from Herberton. Other specimens seen from Cooktown, Cloncurry, Cape York, and Torres Straits Islands, about 20 in all.

Type. Adult male. B.M. no. 15. 3. 13. 3. Original number 549. Presented by the Australian Museum, Sydney.

This species, while readily distinguishable from all the previous ones by its bifurcate baculum and small bullæ, is somewhat nearly allied to the next, *N. microtis*. From that, however, it differs by its rather larger size, heavier skull, longer palate, and by the considerably greater stoutness of its baculum. All five of the bacula I have examined are of similar thickness, and contrast markedly with the slender bone extracted from the type of *N. microtis*.

6. *Nyctophilus microtis*, Thos.

Ann. & Mag. N. H. (6) ii. p. 226 (1888).

Size rather smaller than in *N. bifax*. Ear short. Nose-leaf of medium development. Skull smaller and more slenderly built than in *bifax*. Baculum essentially as in *bifax*, but very much more slender.

The typical skull has the palato-sinual length 5.3 mm., maxillary tooth-row 5.6. A more perfect skull from the Aroa River is measured below. Baculum 3.5.

Hab. British New Guinea.

Deceived by the indifferent material then available, I somewhat exaggerated in my original description the shortness of of the ears of this bat. They are really but little shorter than those of *N. bifax*, and do not indicate any near relationship with *N. walkeri*.

Of this species two colour races may be distinguished :—

a. *N. microtis microtis*.

Colour brown, about as in *N. bifax* ; under surface not, or scarcely, lighter than upper.

Hab. Sogere, Owen Stanley Range.

Type. B.M. no. 88. 4. 14. 1.

b. *N. microtis bicolor*, subsp. n.

Colour greyish brown ("olive-brown") above. Under surface strongly contrasted greyish white, the hairs slaty at their bases, their terminal halves creamy white.

Dimensions of the type (measured on the skin):—

Forearm 40 mm.

Ear (moistened) 21×14.5 . Third finger, metacarpal 37, first phalanx 14.5 ; lower leg and hind foot (c. u.) 25.5 .

Skull: greatest length 16.5 ; palato-sinual length 6; maxillary tooth-row 5.9 .

Hab. Aroa River, British New Guinea. Near coast.

Type. B.M. no. 5. 11. 28. 2. Collected 20th December, 1904, by A. S. Meek.

This bat is presumably the representative in the low-lying coast-country of the *N. microtis* of the mountains behind. I have, however, seen neither spirit-specimen nor baculum of it, so that it may possibly prove to be more distinct from *N. microtis* than I can now determine.

7. *Nyctophilus dædalus*, sp. n.

Size fairly large. Ears about as in *N. bifax*, smaller than in *gouldi*. Colour, of a skin from Melville Island, rich brown, between Prout's brown and mummy-brown; under-side lighter, near "Saccardo's umber." Nose-leaf low, little developed, as No. 1 above. Skull much as in *N. bifax*, the bullæ markedly smaller than in *N. gouldi*. Baculum short, tapering, flattened terminally, not bifurcate.

Dimensions of the type (in spirit):—

Forearm 41 mm.

Head and body 52; tail 41; ear 22×15.5 ; third finger, metacarpal 37.5 , first phalanx 15; lower leg and hind foot (c. u.) 25. Baculum 3.7 .

Skull: greatest length 17.3 ; condylo-basal length 16; zygomatic breadth 11.6 ; palato-sinual length 6.6 ; maxillary tooth-row 6.5 ; bullæ 3.6 .

Hab. Northern Territory. Type from the Daly River; other specimens from Port Essington and Melville Island.

Type. Adult male. B.M. no. 97. 4. 12. 8. Collected July 1894 by Dr. Dahl. Received in exchange from the Christiania Museum.

This species differs from *N. gouldi* by its smaller bullæ and less developed nose-leaf, and from *N. bifax* by its simple baculum.

8. *Nyctophilus walkeri*, Thos.

Ann. & Mag. N. H. (6) ix. p. 405 (1892).

Size conspicuously smaller and ears shorter than in any other species. Nose-leaf of medium development (No. 2). Baculum not known.

Skull far smaller than in other species, bullæ hardly larger than in ordinary short-eared Vespertilionine bats.

Forearm 33·5 mm.

Skull: greatest length 13; condylo-basal length 12·2; bulla 2·8; maxillary tooth-row 4·7.

Hab. Northern Territory (Adelaide River).

Type. Adult female. B.M. no. 92.4.4.1.

No further specimens of this most distinct little species have as yet been recorded. By its small size, proportionally small ears, and the correspondingly reduced bullæ, it may be said to be more different from all the other species than any of them are from each other. But there is nothing to indicate any superspecific distinction.

XLII.—On a minute Shrew from Lake Baikal.

By OLDFIELD THOMAS.

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DURING his recent expedition to Lake Baikal, unfortunately interrupted by the outbreak of war, Mr. G. A. Burney obtained a single specimen of an excessively small shrew, smaller than any *Sorex* known, and rivalling in minuteness the pygmy *Pachyura* of the *hodgsoni* group. It would appear to be allied to the Japanese *Sorex hawkeri* and the more recently described *S. tscherskii*, Ognev*, from the Ussuri. I would propose to call it

Sorex burneyi, sp. n.

Size excessively minute, less than in any known species of the genus. Fur of back only about 2·3 mm. in length (summer). General colour much as in *S. hawkeri*, light brown, near sepia, above, sides and under surface dull drabby whitish, not contrasted with colour of upper parts, and very far from white. Hands and feet dull brownish white. Tail

* Ann. Mus. St. Petersb. xviii. p. 412 (1913).

less than half the length of the head and body, light brown above, darker brown at the tip, white below.

Skull very small and delicate; muzzle not specially slender or drawn out. Interorbital region narrow, its sides evenly converging forwards. Walls of mesopterygoid fossa slightly imperfect, reticulated, though less definitely than in *Blarinella*. Foramina in base of skull behind entopterygoids unusually large.

Upper unicuspidis evenly decreasing in size backwards to the fourth, the fifth slightly larger than the latter; all visible from without.

Dimensions of the type (measured in the flesh):—

Head and body 50 mm.; tail 23·5; hind foot (s. u.) 8.

Skull: greatest length (bone only) 12·5; condylo-incisive length 12·9; greatest breadth 5·9; interorbital breadth 2·3; palatal length 5·1; breadth between outer corners of m^2 3·3; upper tooth-series 5·3; front of p^4 to back of m^2 2·8.

Hab. Listvinechnoya, on L. Baikal, near Irkutsk. Alt. 1400'.

Type. Old female. B.M. no. 15. 3. 9. 10. Original number 38. Collected 21st July, 1914, by G. A. Burney. Presented by Oldfield Thomas.

“Caught in pit-fall in forest.”—*G. A. B.*

This tiny shrew, the smallest mammal of the Palæarctic region, seems only to be related to *Sorex hawkeri* and *tscherskii*. From the former it differs by its still smaller size, shorter tail, shorter tooth-row, and smaller unicuspidis, the first three of which are 1·1 mm. in length taken together in *hawkeri*, 0·8 in *burneyi*. The type-skull of *S. hawkeri* is unfortunately crushed, so that no comparison in that respect is possible.

From the Ussuri species *S. burneyi* differs by its non-contrasted drabby underside as compared with the “merklich abgegrenzt silbergrau-weiße Unterseite” of that species; by its shorter skull, 12·5 instead of 13·4 mm. in length, and by its markedly narrower interorbital region, 2·3 instead of 3·0 mm. in breadth, a difference fully borne out by the skull-photograph published by Dr. Ognev.

It is curious that just after the reticulation of the walls of the mesopterygoid fossa has been described as peculiar to *Blarinella*, it should turn up again in this pigmy shrew; it does not occur in *S. minutus*, but is present in certain of the smaller American species of the genus.

XLIII.—Notes on Costa Rican Heterocera described in the
'Annals and Magazine of Natural History.' By W.
SCHAUS.

Ser. 8, vol. vi. (1910).

- Page 402. *Melese sixola* = *M. punctata*, Roths.
Page 404. *Pachydota josefina* = *P. drucei*, Roths.
—— *inermis* = *P. albiceps*, Walk.
—— *nitens* = *P. rosenbergi*, Roths.
Page 415. *Dalcera*? *innocia* belongs to the Megalopygidæ.
Page 418. *Cicinnus lacuna* = *C. joanna*, Schs.
Page 582. *Heterocampa hemicera* = *H. notabilis*, Schs.

Ser. 8, vol. vii. (1911).

- Page 34. *Eriopyga rubicundula* belongs to the genus *Chabuata*.
Page 38. *Speocropia grandimacula* = *hadenoides* (Homoptera),
Walk.
Page 41. *Heterochroma ligata* is a Notodont of the genus *Eragisa*.
Page 54. *Safia minor* = *S. minta*, Schs. = *lucilia*, Mösch.
Page 56. *Cænipeta sororia* = *suttea*, Guen.
Page 62. *Dyomyx obliquata* = var. of *jonesi*, Schs.
Page 70. *Capnodes apicata* = *Hyphenaria contracta*, Walk.
Page 75. *Focilla vulgaris* = *insana*, Guen.
Page 77. — *laloides*; the name must be changed to *laluma*, as
a *Focilla laloides* has been described by Dognin.
Page 187. *Letis albociliata* = *albifimbria*, Walk.
Page 282. *Anita costalis* = *basipuncta*, Schs.
Hemiceras amanda = *nigrescens*, Schs.
Page 284. — *lepida* = *losa*, Druce.
Page 613. *Propyria normani* = *Ptychoglène xylophila*, Druce.

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- Page 211. *Phobolosia*, not *Phobalosia*.
Page 224. *Oroscopta delicata* = *Freilla alberti*, Schs. = *privigna*,
Mösch.
Page 230. Generic name should read *Glenopteris*.
Page 586. *Microgonia singularis* is possibly the ♀ of *Herbita tene-*
brica, Dognin.
Page 586. *Herbita divisa* = *medama*, Druce.
Page 593. *Azelina solitaria* is the female of *albivena*, Warr.
Page 600. *Melanolophia directilinea* = *Tephrosia intervallata*, Warr.

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- Page 35. *Cosmosoma thia* is preoccupied; change to *thiacia*.
Page 39. *Turuenna electa*: the specimen described as a male is a
female and = *violascens*, Herr.-Schäff. The name
electa can be retained for the female described.

- Page 40. *Turuenna festiva*=*violascens*, Herr.-Schäff. The name *festiva* can be retained for the female described.
- Page 41. *Claphe braganzoides*=*braganza*, Schs.
- Page 46. *Carthara subrufa* ♂ = *umbrata*, Schs.; the ♀ is possibly a variety of *livida*, Druce.
- Page 51. *Meragisa proxima* is the female of *politoides*, Schs.
- Page 208. *Scopifera repanda* should read *Pyrgion repanda*.
Rejectaria marginalis belongs to the genus *Mamerthes*, and the specific name should be changed to *terminalis*, as *marginalis* is preoccupied.
- Page 209. *Rejectaria splendida*=*Narceea atra*, Dognin.
Strathocles funebris should be *Rejectaria funebris*.
Aristaria vinasalis should be *Renia vinasalis*.
- Page 210. *Neohermenia modestalis* should be *Rejectaria modestalis*.
Tortricodes barbaralis should be *Lascoria barbaralis*.
- Page 211. *Megachyta rona* should be *Physula rona*.
 — *acutipennis* should be *Upothemia acutipennis*.
- Page 212. *Hypena cachialis* is a form of *variabilis*, Druce.
 — *devealis* is a form of *drucealis*, Schs., in which the medial patch is paler.
- Page 214. *Hypena thontes*=*xenarcalis*, Walk.
- Page 428. *Nelo tamfana*=*satellitita*, Warr.
- Page 538. *Cambogia multilunata* is preoccupied; change to *lunatissima*.
- Page 669. *Stericta apicalis*=*Jocara apicalis*, Schs.

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- Page 232. *Pyrrhia rufinaria*=*sanitaria*, Schs.=*fridolinata*, Obt.
Metanema striolata=*Apicia jodea*, Druce.
- Page 237. *Alcis aglauros*=*sonicaria*, Schs.
- Page 292. *Anisodes arastus*=*Heterophya fulvescens*, Warr.
- Page 304. *Perizoma pudens*=*Psaliodes basiplaga* ♀.
 — *tetrica*=*Psaliodes basiplaga* ♂.
- Page 310. *Dolichoneura squalida*=*albidentata*, Warr.
- Page 518. *Argidia aufidia* is probably *palmipes*, Guen.
- Page 524. *Capnodes lycdris*=*tuva*, Schs.
- Page 526. *Homopyralis albifasciata*=*Lithacodia merta*, Schs.
- Page 531. *Elecussa* should read *Elocussa*.

Ser. 8, vol. xi. (1913).

- Page 1. *Ostha concinna* belongs to the genus *Glympis*.
- Page 6. *Mastigophorus pasithea*=*Charmodia vectis*, Mösch.
- Page 17. *Epizeuxis zentium*=*Bleptina lascea*, Druce.
- Page 255. *Casuarina angulinea* probably = *Saccopleura lyceatis*, Dyar.
- Page 262. *Pionea lagunalis*=*P. autoclesalis*, Walk.
- Page 371. *Eupithecia josefina*=*sellia*, Warr.
- Page 374. — *rufa*=*anita*, Warr.
- Page 381. *Docephora discordans*=*fumosa*, Warr.
- Page 386. *Antiplema clipearia*=*Antiplecta nigripleta*, Warr.

XLIV.—*A few undescribed Rhynchota.*

By W. L. DISTANT.

THE types of the following genera and species are all in the British Museum :—

HETEROPTERA.

Fam. Pentatomidæ.

Bolbocoris pretorius, sp. n.

Vertex of head ochraceous, somewhat coarsely punctate, base between eyes and lateral margins of the central lobe black; pronotum pale stramineous, darkly, coarsely punctate, the anterior margin and a central longitudinal line levigate; behind the anterior margin is a transverse black fascia containing a small ochraceous spot on each side and medially divided by the central levigate line; scutellum pale stramineous, darkly punctate, with a central robust longitudinal ridge, a levigate slightly elevated pale stramineous spot near each basal angle, between and beyond these spots the colour is black speckled more or less with testaceous, a testaceous spot on lateral margin beyond middle; connexivum pale stramineous; body beneath and legs pale stramineous, the body more or less spotted with black, more largely so on sternum; antennæ with the first, fourth, and fifth joints black, second and third ochraceous, fourth moderately incrassate, fifth strongly so, fourth much shorter than fifth; body elongate, breadth between pronotal angles about equal to length of scutellum.

Long. 4 mm.

Hab. Transvaal; Pretoria.

Separated from the other species of the genus by its more elongate form and its distinct coloration and markings.

Carbula recurva, sp. n.

Head and pronotum pale ochraceous, more or less thickly blackly punctate, the lateral frontal margins levigately ochraceous, the posteriorly produced lateral pronotal angles black; scutellum pale ochraceous, more or less blackly punctate, a large levigate ochraceous spot at each basal angle, the apex and centre of apical area much less punctate, and therefore more pale stramineous in hue; corium very thickly blackly punctate; membrane fuliginous; connexivum pale ochraceous, with large prominent black spots; body beneath

and legs pale ochraceous; sternum moderately blackly punctate, disk of abdomen thickly blackly punctate, almost unicolorous, remaining area darkly punctate, with a sinuate longitudinal fascia of black punctures on each side, extreme lateral margin spotted with black at apices of abdominal segments; legs ochraceous, with a small black spot near apices of femora; antennæ ochraceous, second and third joints subequal in length, each shorter than fourth or fifth joints, which are also subequal; head with the apex broadly subtruncate, posterior pronotal angles acutely produced, their apices distinctly curved backwardly.

Long. 6-7 mm.; exp. pronot. angl. $4\frac{1}{2}$ -5 mm.

Hab. Transvaal; Johannesburg (A. Ross); Pretoria, Waterberg District.

One varietal specimen has the pronotal angles not acutely produced.

Fam. Lygæidæ.

Lygæus swynnertoni, sp. n.

Somewhat dark ochraceous; antennæ, apex of vertex of head, and a basal spot at inner margin of eyes, broad anterior margin connected with two longitudinal sublateral fasciæ to pronotum, basal margin to scutellum, claval area and a marginal spot curved backwardly on costa of corium, basal margin of membrane, sternum, rostrum, and legs black or blackish; anterior and intermediate femora apically annulated with ochraceous; abdomen beneath ochraceous, the apical segment black, membrane fuscous brown, reflecting the dark abdomen beneath; basal joint of antennæ reaching or slightly passing the apex of head, second joint slightly longest, third and fourth subequal in length; pro-, meso-, and metasterna each with a prominent black spot near lateral margins, that on prosternum tuberculous.

Long. 11 mm.

Hab. South Rhodesia (C. F. M. Swynnerton, Brit. Mus.). Allied to *L. bettoni*, Dist.

Fam. Hydrometridæ.

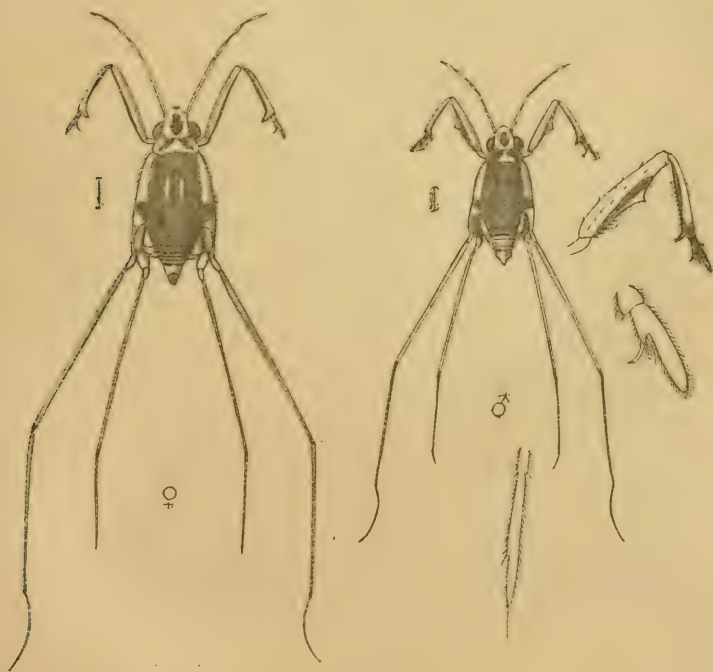
Subfam. GERRINÆ.

ASCLEPIOS, gen. nov.

Head about as long as broad, conically rounded anteriorly beyond the insertion of the antennæ; eyes longer than broad, a little obliquely produced over the anterior angles of the

pronotum; antennæ with the first joint longest, about as long as the anterior femora, second almost half as long as first and a little longer than either third or fourth; rostrum reaching the anterior coxæ; pronotum considerably shorter than head, anterior and posterior margins very slightly sinuate, the lateral margins rounded, moderately, centrally, longitudinally depressed; mesonotum about twice the length of pronotum; hemelytra rudimentary in all the specimens at present examined; anterior femora in ♂ only moderately incrassate, scarcely more so than in ♀, but armed with a broad and distinct spine a little beyond middle, unarmed in ♀; anterior tarsus with a distinct curved bristle near base.

The most marked character of this genus is to be found in the strongly spined femora of the ♂.



Asclepios annandalei, sp. n. (See text-figure.)

Head above ochraceous, with a broad central longitudinal spot and the extreme apex black, eyes also black; antennæ with the first and second joints ochraceous, extreme apex of

the second and the whole of the third and fourth joints more or less blackish ; pronotum ochraceous, with a large, oblique, dark olivaceous spot on each lateral area ; mesonotum olivaceous brown or dark olivaceous, finely greyishly pubescent, the lateral margins ochraceous, with a posterior dark olivaceous spot ; in the ♀ there are frequently two linear ochraceous spots on the disk ; abdomen above olivaceous, the apex and segmental margins more or less ochraceous ; body beneath ochraceous, finely greyishly pubescent ; legs ochraceous, anterior femora and tibiæ more or less distinctly streaked with black, anterior femora with the apex sometimes black, tibiæ (and especially the tarsi) more or less infuscated ; structural characters as in generic diagnosis.

Long., ♂ 3, ♀ 4 mm.

Hab. Salt Lakes near Calcutta and in backwater at Ennar (*Annandale*).

Fam. Saldidæ.

Salda rutherfordi, sp. n.

Body above black ; a spot at anterior margins of eyes, lateral margins of pronotum (attenuated and not quite reaching basal angles), narrow central posterior margin of pronotum, base of lateral margins to corium, and large spots to connexivum ochraceous ; body beneath black, more or less greyishly tomentose ; segmental and posterior margins to sternum, costal spots and legs pale ochraceous ; abdomen with the central margins dark, and lateral marginal spots pale ochraceous ; vertex of head longer than broad, anteriorly rounded ; base of rostrum with two transverse central ochraceous lines between the eyes ; head, pronotum, and scutellum shining, more or less distinctly punctate ; corium more opaquely coloured, and obscurely spotted with greyish blue ; membrane piceous, the apical margin pale brownish or dark ochraceous.

Long. $4\frac{1}{2}$ mm.

Hab. Ceylon ; Peradeniya.

Named after the late Mr. A. Rutherford, the local Government Entomologist at Peradeniya.

HOMOPTERA.

Fam. Cercopidæ.

Subfam. *APHROPHORINÆ*.

HINDOLOIDES, gen. nov.

Vertex of head much broader than long, the anterior

margin angularly subrotundate, the posterior margin more angulately subconcave, about twice as broad as long, ocelli near base and on the lateral margins of the central lobe; face globose, projecting, longer than broad, clypeus short and broad; pronotum convex, considerably broader than long, the anterior margin convex, the posterior margin profoundly concavely sinuate, the lateral margins moderately oblique, slightly concave near base; scutellum considerably longer than broad, the apex acute, the lateral margins straightly oblique; tegmina more than twice as long as broad, about basal two-thirds coriaceous and coarsely punctate, apical area subhyaline, the apices broadly rounded, subapical cells three, the innermost small; posterior tibiae with two strong spines, posterior tarsi robust, the basal joint longest.

Allied to the Australian genus *Hindola* (= *Carystus*, nom. præocc.), but differs by the totally different structure of the face and the shorter and apically broader tegmina.

Hindoloides indicans, sp. n.

Head, pronotum, scutellum, body beneath, and legs ochraceous; tegmina with nearly basal two-thirds ochraceous, remainder dull subhyaline; eyes black, with two large black spots on face between them; meso- and metasterna sometimes spotted with black, but this is not a constant character; structural characters as in generic diagnosis.

Long., incl. tegm., $3\frac{1}{2}$ –4 mm.

Hab. Calcutta, on *Zizyphus jujuba*.

XLV.—*On the African Shrews belonging to the Genus Crocidura.* By GUY DOLLMAN.

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THE following paper deals with the African members of the genus *Crocidura*. The forms *russula*, *r. mauritanica*, and *whitakeri* are not included, since they belong more to the European fauna than to the African.

It has not been found possible to prepare a thoroughly sound key; in the groups "medium-sized" and "small-sized" a certain amount of overlapping exists, a few of the small-sized species possessing either body or cranial dimensions which make it impossible to draw any definite line of distinction between the two groups.

As the flesh and skull measurements in this genus are of such great systematic importance, and in view of the fact that in certain species a considerable amount of individual or sexual variation exists in these dimensions, it has been thought best to give, wherever possible, the measurements of a series rather than of a single individual. Further, as regards colour (an almost equally important factor), owing to the great amount of seasonal variation, it has been found necessary to deal with the question in considerable detail.

The cranial dimensions used are those usually employed, with the exception of the depth or height of the brain-case, which is here taken from the basioccipital to the highest point of the lambdoidal crest; the ordinary measurement, the greatest depth, is very unsatisfactory in this genus, as so many skulls are imperfect in the auditory region. The measurement given for the upper tooth-row is taken from the extreme front of the first incisors to the back of the last molar.

The arrangement adopted in this paper is necessarily of rather an artificial nature; the chief object aimed at is to give some general plan that may assist in the identification of the species of this unwieldy genus.

It has been found necessary to describe thirty-eight new forms, many of which are here ranked as races rather than species; in this manner it is possible to keep the allied forms together, a point of very considerable importance when dealing with a genus of such dimensions.

Key to the Species and Subspecies.

- A. Caudal bristle-hairs usually numerous and evenly distributed over proximal two-thirds of tail.
 - a. Size very large: length of skull more than 33 mm.
 - a'. Size larger: length of skull 36 mm.; hair and tail exceptionally long. (Gold Coast.). (1) *giffardi*, de Wint.
 - b'. Size smaller: length of skull 34 mm. or less; hair and tail not exceptionally long.
 - a². Colour deep chocolate-brown. (Sennaar.) (11) *hedenborgiana*, Sund.
 - b². Colour paler.
 - a³. Colour above pale drab. (Lagos.) (2) *manni*, Pet.
 - b³. Colour above rich chestnut-brown (dark "burnt umber"). (Kilimanjaro.). (12) *martiensseni*, Neum.
 - c³. Colour above dark greyish brown. (Gaboon.) (3) *odorata*, Leconte.
 - b. Size large: skull less than 33 mm. in length (between 26-32.5); head and body 93-140; hind foot 15-22.
 - a'. Second upper unicuspid smaller than third.

- a*². Caudal bristle-hairs exceptionally numerous and very long. Colour above dark slaty brown. (Kaffa, Abyssinia.) (23) *zaphiri*, sp. n.
- b*². Caudal bristle-hairs normal. Colour pale umber. (Egypt.) (24) *olivieri*, Less.
- b*¹. Second and third upper unicuspid about equal in size.
- a*². Lower surface of tail strikingly lighter than upper.
- a*³. Size larger: skull 28·4–30 mm. in length. (Abyssinia.) (21) *doriana*, Dobs.
- b*³. Size smaller: skull 26·7–28·6 mm. in length. (South Africa.) (22) *flavescens*, Is. Geoff.
- b*². Lower surface of tail not conspicuously lighter than upper.
- a*³. Colour above dark chocolate-brown.
- a*⁴. Tail longer (70–80 mm.). (Lake Kivu.)
(16) *n. kivu*, Osg.
- b*⁴. Tail shorter (60 mm.). (Kaka, White Nile.)
(13) *fuscosa*, Thos.
- b*³. Colour above dull coffee-brown.
- a*⁴. Size larger: head and body 120 mm.; tail 80; hind foot 21·5; tooth-row 14·8. (Mersetter, S. Rhodesia.) (18) *n. zuleika*, subsp. n.
- b*⁴. Size smaller: head and body 105 mm.; tail 65; hind foot 18; tooth-row 13·1. (Blantyre, Nyasaland.) (19) *n. hera*, subsp. n.
- c*³. Colour above pale buffy drab. Tooth-row 13–13·3 mm. (Lado.) (20) *sururae*, Hell.
- a*³. Colour above reddish brown in both new and worn pelage.
- a*⁴. Colour above reddish umber.
- a*⁵. Size larger: head and body 115–140 mm.; hind foot 18–20; length of skull 30–32·5. (Ussoga, Victoria Nyanza.)
(14) *nyansæ*, Neum.
- b*⁵. Size smaller: head and body 100 mm.; hind foot 18; length of skull 26·9. (Mt. Gargues, B.E.A.) (17) *n. tatiana*, subsp. n.
- b*⁴. Colour above chestnut-brown. Hind foot 19–22 mm. (Kijabe, B.E.A.)
(15) *n. kijabæ*, Allen.
- e*³. Colour above dark sepia in new coat, reddish brown in worn pelage.
- a*⁴. Tail longer (63–82 mm.).
- a*⁵. Colour above dark sepia or reddish brown. Skull 26·5–29·5 mm. in length. (Gaboon.)
(4) *occidentalis*, Puch.
- b*⁵. Colour above sepia or reddish brown, sprinkled with silvery grey. Skull 29·8–31 mm. in length. (Gold Coast.) . (5) *o. spurrelli*, Thos.
- b*⁴. Tail shorter (62–63 mm.). Ventral surface paler than in *a*⁴. (Angola.) . . (10) *anchietæ*, Boc.
- f*³. Colour above dark greyish brown. Head and body 106 mm.; hind foot 18; tooth-row 13. (Jala, Sierra Leone.) (7) *o. cara*, subsp. n.

- c. Size medium: head and body 64-115 mm.; hind foot 11-17; length of skull 21-26.5; tooth-row 8.5-12.
- α' . Third upper unicuspid larger than second.
- α^2 . General colour grey.
- α^3 . Lower surface of body distinctly paler than upper.
Tooth-row 10.2. (Lukenya Hills, B.E.A.)
(81) *f. schistacea*, Osg.
- b^3 . Lower surface of body only slightly paler than upper. Tooth-row 11. (Mt. Gargues, B.E.A.)
(84) *raineyi*, Hell.
- b^2 . General colour brownish or blackish.
- α^3 . Third upper unicuspid markedly broader than second.
- α^4 . Fur short (5 mm. in length on back); third upper unicuspid oval in transverse section; tooth-row 10.5. (Chagwe, Uganda.)
(82) *f. selina*, subsp. n.
- b^4 . Fur long (8 mm. in length on back); third upper unicuspid almost circular in transverse section; tooth-row 10.9. (Chiromo, Nyasaland.)
(83) *f. johnstoni*, subsp. n.
- b^3 . Third upper unicuspid not very markedly broader than second.
- α^4 . Colour above sepia-brown mottled with greyish buff. (Mt. Kenya, B.E.A.)
(79) *fumosa*, Thos.
- b^4 . Colour above dark slaty black. (Mt. Ruwenzori.)
(80) *f. montis*, Thos.
- b' . Third upper unicuspid about equal in size to second.
- α^2 . Colour above dark brownish or blackish brown.
- α^3 . Caudal bristle-hairs very few in number, restricted to proximal end. Colour dark blackish brown. Tooth-row 12. (Como River, Gaboon.)
(60) *batesi*, sp. n.
- b^3 . Caudal bristle-hairs normal.
- α^4 . Tail shorter, 40 mm. or less.
- α^5 . Colour above almost black. Tail 32 mm. in length; hind foot 12.5. (Angola.)
(51) *t. angolæ*, subsp. n.
- b^5 . Colour above sepia-brown, speckled with golden buff. Tail 35-40 mm. in length; hind foot 13. (Gold Coast.)
(59) *p. pamela*, subsp. n.
- c^5 . Colour above brownish black. Tail 40 mm. in length; hind foot 15. (Liberia.)
(9) *büttikoferi*, Jent.
- b^4 . Tail longer, more than 40 mm. in length.
- α^5 . Size larger: head and body 98-115 mm.; length of skull 24.5-26.5; tooth-row 10.6-11.5.
- α^6 . Colour above mummy-brown, below greyish brown. Head and body 115 mm.; length of skull 25.5; tooth-row 11.3. (Kampala, Uganda).... (52) *t. mutesæ*, Hell.
- b^6 . Colour above dark sepia-brown, below

- greyish brown. Head and body 98 mm.; length of skull 26; tooth-row 11·5. (Asaba, Nigeria.) . . (6) *o. nigerica*, subsp. n.
- c⁶. Colour above dull coffee-brown, below grey. Head and body 103–107 mm.; length of skull 24·5–25·3; tooth-row 10·6–11. (Beira, B.E.A.) (25) *beiræ*, sp. n.
- b⁵. Size smaller: head and body 80–98 mm.; length of skull 21–25; tooth-row 9·1–10·7.
- a⁶. Colour above dull blackish or olive-brown.
- a⁷. Tail shorter: 43·5–56 mm. in length.
- a⁸. Colour above dark blackish brown speckled with greyish buff, below greyish. Hind foot 14–15; tail 43·5–50). (Lake Bangweolo.)
(45) *turba*, Dollm.
- b⁹. Colour above dark olive-brown speckled with golden buff, below brownish grey. Hind foot 14·5–15·5 mm.; tail 45–51. (Aberdare Mts., B.E.A.)
(48) *t. provocax*, Thos.
- c⁸. Colour above olive-brown. Hind foot 15–15·5 mm.; tail 50–56. (Mt. Elgon, B.E.A.) (49) *t. kempi*, subsp. n.
- d⁸. Colour above dark clove-brown, under parts scarcely paler. Hind foot 14·5 mm.; tail 48. (Lado.)
(53) *nilotica*, Hell.
- b⁷. Tail longer (56–65 mm.).
- a⁸. Colour above dark blackish brown. Head and body 98–110 mm.; tail 56–65; hind foot (c. u.) 17–18. (Nairobi, B.E.A.) . . (46) *t. zaodon*, Osg.
- b⁹. Colour above dark blackish brown finely speckled with buff. Head and body 94 mm.; tail 63·5; hind foot 17. (Lake Bangweolo.)
(54) *zena*, sp. n.
- c⁸. Colour above pale clove-brown thickly sprinkled with silvery grey. Head and body 91–100 mm.; tail 50–58; hind foot 15–17. (Chaya, nr. Kivu, Congo.) (50) *t. tarella*, subsp. n.
- d⁸. Colour above brownish umber. Head and body 98 mm.; tail 59; hind foot 16. (Angola.) . (55) *ansorgei*, sp. n.
- e⁸. Colour above brownish umber finely speckled with grey. Head and body 90–95 mm.; tail 48–56; hind foot 15–15·5. (Liberia.) . (8) *schweitzeri*, Pet.
- b⁶. Colour above dark reddish brown.
- a⁷. Size larger: hind foot 15–16 mm.; length of skull 22·9–25.

- a*³. Colour dark reddish brown above and below.
- a*³. Skull longer (24·3–25·1 mm.); tail 47–52; tooth-row 10·6–10·7. (Nyika Plateau, N. Nyasa.)
(26) *b. nyikæ*, subsp. n.
- b*⁹. Skull shorter (23 mm.); tail 57; tooth-row 10·4. (Lakiundu R., B.E.A.) . . (47) *t. lakiundæ*, Hell.
- b*⁸. Colour above dark reddish brown, below grey.
- a*⁹. Skull longer (25 mm.). (Old Calabar, Nigeria.) . . (57) *p. soricoides*, Murray.
- b*⁹. Skull shorter (22·9 mm.). (Fernando Po.) . (56) *poensis*, Fras.
- b*⁷. Size smaller; hind foot 12–14 mm.; length of skull 21–21·7. Colour yellowish brown above, grey below. (Cameroons.)
(58) *p. attila*, subsp. n.
- b*². Colour above bright cinnamon-buff or dull chestnut, greyish white below.
- a*³. Tooth-row longer (9–9·8 mm.).
- a*⁴. Size larger: head and body 83–105 mm.; hind foot 13–15.
- a*⁵. Size larger: skull more than 24 mm. in length.
- a*⁶. Upper unicuspid normal.
- a*⁷. Colour above rufous cinnamon. (Machakos, B.E.A.) (32) *hindei*, Thos.
- b*⁷. Colour above cinnamon speckled with pale grey. (Bahr-el-Abiad.)
(34) *sericea*, Sund.
- b*⁶. Upper unicuspid very narrow. Colour above pale sandy buff. (Lake Chad.)
(33) *hindei diana*, subsp. n.
- b*⁵. Size smaller: skull less than 24 mm. in length.
- a*⁶. Colour above cinnamon-brown or grey speckled with cinnamon or fawn.
- a*⁷. Tail longer (51–60 mm.).
- a*⁸. Colour above cinnamon-brown or greyish cinnamon. Tooth-row 9·6–10·3. (Tette.) (27) *hirta*, Pet.
- b*⁸. Colour above darker, without grey speckling. Tooth-row 9–9·6 mm. (Pondoland.) . (29) *h. pondoensis*, Roberts.
- c*⁸. Colour above fawn finely speckled with greyish drab. Tooth-row 9·6 mm. (Voi, B.E.A.) (87) *xanthippe*, Osg.
- b*⁷. Tail shorter (48–51 mm.). Colour above rich cinnamon-brown, grey speckling almost entirely absent in adult pelage. (Umvolosi, Zululand.) [& Schw.
(28) *h. flavidula*, Thos.
- b*⁶. Colour dull brownish chestnut.
- a*⁷. Tail not markedly incrassated at base.

- a*³. Fur short. Tail not distinctly bicolor.
(Usambara, G.E.A.)
(36) *velutina*, Thos.
- b*³. Fur normal. Tail brown above, white below. (Charnia R., B.E.A.)
(35) *beta*, sp. n.
- b*⁷. Tail markedly incrassated at base. (Jombeni Range, B.E.A.)
(40) *percivali*, sp. n.
- b*⁴. Size small: head and body 70-80 mm.; tail 37-40; hind foot 12-13; length of skull 21.
- a*⁵. Colour above pale buffy brown, fading gradually into dirty greyish buff below. (Mozambique.)
(30) *sacralis*, Pet.
- b*⁵. Colour above broccoli-brown, sharply marked off from greyish white of ventral surface. (Lado.) (37) *lutrella*, Hell.
- b*³. Tooth-row shorter (8.6 mm.). Colour above dull brownish buff, below dirty grey. (Tropic of Capricorn, S. Africa.) (31) *mariguensis*, Smith.
- c*². General colour very pale cinnamon or pale smoky grey.
- a*³. Size larger: head and body 92-100 mm.; skull 26 mm. or more in length.
- a*⁴. Tail longer (69 mm.). Broccoli-brown above, drab-grey below. (Mazeras, B.E.A.)
(43) *suahelæ*, Hell.
- b*⁴. Tail shorter (48 mm.). Above slaty grey washed with brownish, below white. (Nguruman, G.E.A.) (41) *fischeri*, Pag.
- b*³. Size smaller: head and body 64-93 mm.; skull less than 25 mm. in length.
- a*⁴. Tail longer (43-53 mm.).
- a*⁵. Colour above pale snuff or light cinnamon, white below. (Molopo R., Bechuanaland.)
(38) *deserti*, Schw.
- b*⁵. Colour above slaty, below dull yellowish or greyish white. (Voi, B.E.A.)
(42) *voi*, Osg.
- b*⁴. Tail shorter (less than 35 mm. in length).
- a*⁵. Colour above pale cinnamon-drab, below creamy grey. Tooth-row 10.3 mm.; upper unicuspid normal. (Bahr-el-Ghazal.)
(39) *butleri*, Thos.
- b*⁵. Colour above pale smoke-grey, below pure white. Tooth-row 9.4 mm.; upper unicuspid crushed close together. (Somaliland.)
(44) *smithi*, Thos.
- d*². General colour grey or greyish brown.
- a*³. Colour pale grey or greyish brown.
- a*⁴. Last upper molar well developed.
- a*⁵. Size larger: head and body 87-98 mm.; tail 50-61; hind foot 14-16.
- a*⁶. Anterior corners of brain-case rounded.

- Colour pale greyish sepia. Tooth-row 11 mm. (Panyam, N. Nigeria.)
(61) *foxi*, sp. n.
- b*⁶. Anterior corners of brain-case square, not rounded.
- a*⁷. Colour above pale grey finely speckled with snuff-brown; tail greyish white. (Katanga, S. Congo.)
(67) *luna*, Dollm.
- b*⁷. Colour above pale grey washed with dark brown; tail blackish brown. (Machakos, B.E.A.) (68) *l. umbrosa*, subsp. n.
- c*⁷. Colour dark slate lightly washed with vandyke-brown; tail greyish white. (Walamo, Abyssinia.)
(69) *l. macmillani*, subsp. n.
- b*⁵. Size smaller: head and body 74-85 mm.; tail 45-64; hind foot 12-15.
- a*⁶. Tail shorter (45-52 mm.).
- a*⁷. Anterior corners of brain-case rounded.
- a*⁸. Tooth-row longer (10.6 mm.). (S. of Tanganyika.) (73) *electa*, Dollm.
- b*⁸. Tooth-row shorter (8.9-9.4 mm.). (Roodeval, S. Africa.)
(71) *argentata*, Sund.
- b*⁷. Anterior corners of brain-case square. Colour above light cinnamon over grey. (Olgerei R., B.E.A.)
(70) *ibeana*, sp. n.
- b*⁶. Tail longer (58-64 mm.). Colour above dull greyish brown, below grey. (Cape.)
(74) *martensi*, Dobs.
- b*⁴. Last upper molar very small.
- a*⁵. Skull flattened. Colour above pale hair-brown over grey. Tail 54 mm. in length. (Angola.)
(63) *erica*, sp. n.
- b*⁵. Skull not flattened. Colour above cinnamon-brown over grey. Tail 49 mm. in length. (Kabwir, N. Nigeria.) (62) *arethusa*, sp. n.
- b*³. Colour very dark slate-grey. (S. Africa.)
(72) *cyanea*, Duv.
- c*¹. Third upper unicuspid smaller than second.
- a*². Colour above dark blackish brown.
- a*³. Tail longer (65 mm.); hind foot 15-16. Ventral surface dull brownish grey. (W. of Semliki, Congo.) (66) *nigrofusca*, Matsch.
- b*³. Tail shorter (52 mm.); hind foot 12. Ventral surface grey. (Angola.) . . . (65) *nigricans*, Boc.
- b*². Colour above light grey washed with pale mummy-brown; ventral surface whitish. (Titebbi, Welle River.) (64) *boydi*, sp. n.
- d*. Size small: head and body 53-86 mm.; hind foot 11-13.5; length of skull 18.5-21.1; tooth-row 7.5-9.4.
- a*¹. Tail shorter (40 mm. or less).
- a*². Size larger (head and body 84-86 mm.).

- a*³. Colour above grey, below white. (Voi, B.E.A.)
(85) *parvipes*, Osg.
- b*³. Colour above brownish, below grey. (Zanzibar.)
(86) *sansibarica*, Neum.
- b*². Size smaller (head and body 53 mm.). Skull rather flattened. (Somaliland.) . . (100) *somalica*, Thos.
- b*¹. Tail longer (45-62 mm. in length).
- a*². Hind foot 12-13·5 mm. in length.
- a*³. Tail longer (58-62 mm.).
- a*⁴. Colour above light cinnamon-brown, white below. (Giza, Egypt.). (110) *floweri*, sp. n.
- b*⁴. Colour above dark sepia-brown, below slate-grey. Skull not flattened. (Mt. Nyiro, E. Africa.) (91) *macowi*, sp. n.
- c*⁴. Colour above vandyke-brown, below drab. Skull flattened. (Mt. Gargues, B.E.A.)
(98) *h. altæ*, Hell.
- b*³. Tail shorter (44-53 mm.).
- a*⁴. Third upper unicuspid markedly broader than second. Colour dark sepia-brown. (Taita Hills, B.E.A.) (93) *lutreola*, Hell.
- b*⁴. Third upper unicuspid about equal or slightly broader than second.
- a*⁵. Extremities and tail covered with coarse black hairs. Colour above and below dark brown. (Transvaal.) (78) *pilosa*, Dobs.
- b*⁵. Extremities and tail normal.
- a*⁶. Colour above slaty grey or greyish brown.
- a*⁷. Colour above slaty grey, below dull grey. Length of skull 19·4 mm.; tooth-row 8·2. (De Kaap, Transvaal.)
(75) *silacea*, Thos.
- b*⁷. Colour above greyish brown, below silvery. Length of skull 18·5 mm.; tooth-row 7·5. (Vivi, Lower Congo.)
(76) *bovei*, Dobs.
- b*⁶. Colour above reddish brown.
- a*⁷. Skulls flattened.
- a*⁸. Colour above dull cinnamon-brown, below greyish; ventral surface of tail not strikingly paler than dorsal.
- a*⁹. Ventral surface of body dull grey. Tooth-row 8·2 mm. (Fort Hall, B.E.A.) (95) *hildegardeæ*, Thos.
- b*⁹. Ventral surface of body light grey. Tooth-row 8·8 mm. (Mt. Lololokui, B.E.A.) (96) *h. procera*, Hell.
- b*⁸. Colour above cinnamon-brown, below greyish white; tail distinctly bicolor, ventral surface white. (Kigezi, S.W. Uganda.) (97) *h. rubecula*, subsp. n.
- c*⁸. Colour above seal-brown. Length of skull 18·3 mm. (Lado.)
(99) *planiceps*, Hell.
- d*³. Colour above slaty grey tinged with

- brown. Length of skull 19.3 mm.
(Asaba, Nigeria.)
(101) *crossei*, Thos.
- b*⁷. Skulls not flattened.
- a*³. Colour above smoky grey mottled with brown and silver. Length of skull 21 mm.; tooth-row 9.2. (Ravine, B.E.A.) (88) *jacksoni*, Thos.
- b*³. Colour above sepia. Length of head and body 68 mm.; skull 20; tooth-row 8.3. (Amala R., B.E.A.)
(89) *j. amalæ*, subsp. n.
- c*³. Colour above dark sepia. Length of head and body 82 mm.; tooth-row 8.5. (Kabula, Muliro.)
(94) *maanijæ*, Hell.
- d*³. Colour above dark sepia. Length of head and body 63 mm.; skull 20.6; tooth-row 9. Anterior corners of brain-case very rounded. (Ituri Forest, Congo.)
(90) *j. denti*, subsp. n.
- e*³. Colour above cinnamon-brown, below greyish brown. Tail appearing almost naked. Length of head and body 65 mm.; skull 20; tooth-row 8.7. (Mt. Kilimanjaro.)
(92) *gracilipes*, Pet.
- b*². Hind foot 10.7–11 mm. in length.
- a*³. Colour above pale cinnamon, below white. (French Gambia.) (109) *cinderella*, Thos.
- b*³. Colour above dirty greyish olive, below grey. (Near Cape Town.) (77) *capensoides*, Smith.
- e*. Size very small: head and body 40–67 mm.; hind foot 8.2–12; length of skull 14.2–17.6; tooth-row 5.9–7.7.
- a*¹. Fur not exceptionally short.
- a*². Skull not flattened. Colour above dark sepia. (Nai-vasha, B.E.A.) (102) *aller*, Osg.
- b*². Skull flattened. Colour above reddish brown. (Mt. Kenya.) (103) *alpina*, Hell.
- b*¹. Fur very short.
- a*². Size larger: skulls from 16.8 to 17 mm. in length.
- a*³. Skull exceptionally flat. Colour above greyish cinnamon. (Mauritania.)
(116) *lusitana*, sp. n.
- b*³. Skulls not markedly flattened.
- a*⁴. Colour above slaty brown. (Angola.)
(104) *bicolor*, Boc.
- b*⁴. Colour above brownish. (Victoria Nyanza.)
(107) *b. cunninghamei*, Thos.
- c*⁴. Colour above slaty. (Mt. Elgon, B.E.A.)
(108) *b. elgonius*, Osg.
- d*⁴. Colour above cinnamon. (Lake Ngami.)
(105) *b. woosnami*, subsp. n.

- e*⁴. Colour above brownish sepia. (Nyasaland.)
(106) *b. hendersoni*, subsp. n.
- b*². Size smaller: skulls from 14·2 to 16 mm. in length.
Skulls all exceptionally flat.
- a*³. Colour above dark brownish snuff, greyish white
below. (Zungeru, N. Nigeria.)
(114) *glebula*, sp. n.
- b*³. Colour above mouse-grey, below light grey. Skull
15·8 mm. (Egypt.) .. (115) *religiosa*, Geoff.
- c*³. Colour above dark grey washed with reddish brown,
below greyish white. Skull 16 mm. (Somali-
land.) (111) *nana*, Dobs.
- d*³. Colour above slate-grey, below dull greyish white.
Skull 15·1 mm. (Uganda.)
(112) *namilla*, Thos.
- e*³. Colour above pale cinnamon, white below. Skull
14·4 mm. (Atbara R., Sudan.)
(113) *pasha*, sp. n.

B. Caudal bristle-hairs almost entirely absent, only a few
present at the extreme base of the tail.

- a*. Size medium: head and body 63-96 mm.; tail 50-84;
hind foot 13-17; length of skull 20-24·1; tooth-row
8·2-11.

a'. Tail very long, 80 mm. or more in length. (Came-
roons.) (117) *dolichura*, Pet.

b'. Tail shorter, less than 70 mm. in length.

*a*². Size larger: skull 24 mm. in length.

*a*³. Colour above dark brown. (E. shore of Albert
Nyanza.) (122) *littoralis*, Hell.

*b*³. Colour above dark slate. (Kilimanjaro.)
(121) *monax*, Thos.

*b*². Size smaller: skull less than 23 mm. in length.

*a*³. Hind foot 13 mm. in length (tooth-row 8·2). (Mt.
Ruwenzori.) (119) *niobe*, Thos.

*b*³. Hind foot 14 mm. or more.

*a*⁴. Small upper unicuspid very narrow. Tooth-row
9·1 mm. (Entebbe, Uganda.)
(118) *maurisca*, Thos.

*b*⁴. Small upper unicuspid not narrow.

*a*³. Colour above reddish brown. Tooth-row 10·2
mm. (Nyeri Dist., B.E.A.)
(123) *ultima*, sp. n.

*b*⁵. Colour above very dark blackish brown.

*a*⁶. Tail almost naked. Tooth-row 9·1 mm.
(Kafue R., N. Rhodesia.)
(124) *neavei*, Wrought.

*b*⁶. Tail fairly hairy. Tooth-row 9·1-9·4 mm.
(N.E. Transvaal.) (125) *sylvia*, Thos. & Schw.

b. Size small: head and body 44 mm.; tail 41; hind foot
10·7; length of skull 15·3; tooth-row 6·3. (N.E. of
Lake Rudolf.) (120) *bottegi*, Thos.

Group 1 (*giffardi*).

Size very large. Colour above and below deep chestnut-brown. Fur and tail very long. Second and third upper unicuspid about equal in size.

(1) *Crocidura giffardi*, de Wint.

Crocidura giffardi, de Winton, Ann. & Mag. Nat. Hist. (7) vol. ii. p. 484 (1898).

A very large, dark, long-haired species.

Size larger than in any other African *Crocidura*, tail very long.

Pelage different from all the other allied *Crocidura*; fur exceptionally glossy and long; hairs between 7 and 12 mm. in length on the back. Colour as dark as in *hedenborgiana*, but richer and redder, about as in "dark bone-brown" mixed with "vandyke-brown" (Ridgway, 1912); flanks and belly a trifle lighter, but not markedly so. Hairs reddish brown almost throughout their whole length, only the extreme basal portions pale grey, very different from the ordinary *Crocidura* colouring where the grey hair-bases are very conspicuous. Backs of hands and feet clothed with fairly long, dark, blackish hairs. Tail exceptionally long and covered entirely with black hairs; caudal bristles black and long.

Skull very large and heavily built, very broad across the maxillary and cranial regions; teeth large.

Dimensions of the type (from dried skin):—

Head and body 130 mm.; tail 95; hind foot 23.

Skull: condylo-incisive length 36.1; greatest breadth 14.5; least interorbital breadth 6.9; length of palate 15.7; post-palatal length 15.5; greatest maxillary breadth 12; length of upper tooth-row 17.

Hab. Moshi (or Mossi), near Wagadugu, 500 miles N.E. of Kumasi, Gold Coast.

Type. Adult female. B.M. no. 98. 10. 24. 5.

The dark rich colouring, long fur, and exceedingly long tail readily separate this form from all the other large species.

Group 2 (*manni*).

Size very large. Colour above drab washed with pale cinnamon, below smoke-grey. Second and third upper unicuspid about equal in size.

(2) *Crocidura manni*, Pet.

Crocidura manni, Peters, SB. Ges. naturf. Fr. Berl. p. 19 (1878).

A large species, unusually pale in general colour.

Size a little smaller than in *giffardi*, considerably larger than *nyansæ* or *occidentalis*.

Fur rather harsh and long, not so velvety as is usually found in this genus. Colour of adult pelage pale cinnamon-grey ("drab" mixed "buffy brown"), greyer on the flanks and belly; underparts washed with pale buff ("smoke-grey"); hairs all with slate-grey bases and whitish or buff-coloured tips. Backs of hands and feet brownish. Tail cylindrical, less hairy than in *giffardi*. Dark brown above, underside a shade lighter.

Peters, in his preliminary diagnosis of this species, describes the colour as follows:—" *Crocidura manni*, *n. sp.* Cr. *supra cano cinnamomeus*, *subtus cinnamomeocanus*, *pilis basi cinereis*; *cauda pedibusque ferrugineus* . . ."

Skull large and heavy, rather shorter and blunter than that of *giffardi*; muzzle broad and thick. In length about equal to *hedenborgiana*, but broader across the maxillary region. Teeth large: second and third unicuspid about equal in size, third slightly overlapping the second.

Dimensions as given by Peters:—

Head and body 120 mm.; tail 83; hind foot (c. u.) 22–23.

In the Museum Collection there are four topotypes and one specimen from Asaba preserved in spirits, and a small series of skins from various localities in Northern and Southern Nigeria. The following are the dimensions of the adult individuals:—

	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Head and body ..	130	132	126	120	125	136	128
Tail	84	84	92	82	96	83	75
Hind foot	21·5	21·5	22·2	20·2	22·5	21	20
Ear	12	13	12	12·5	12	13	11

Skull-dimensions taken from five thoroughly adult specimens:—

	♂. Lagos. mm.	♂. Asaba. mm.	♂. Awka. mm.	♀. Lagos. mm.	♀. Bauchi. mm.
Condylar-incisive length	33·2	34·2	34	33	33·2
Greatest breadth	13·6	13·2	14·3	13·4	14
Least interorbital breadth ..	6·8	6·4	7	6·2	6
Length of palate	15	15	15·7	14·5	14·7
Postpalatal length	13·5	14·6	14·3	13·8	13·9
Greatest maxillary breadth ..	11	10·2	11	10·7	10·9
Length of upper tooth-row .	15·7	15·2	14·5	14·5	15·4

There is no marked difference in size between the two sexes in this species.

Hab. Lagos, Southern Nigeria.

The National Collection possesses specimens of *manni* from the following localities :—Lagos, Abutshi (S. Nigeria), Awka District (S. Nigeria), Asaba (S. Nigeria), Bauchi Province (N. Nigeria), and Nassarawa Province (N. Nigeria).

The pelage of this shrew evidently undergoes a considerable colour-change at certain times; in the collection are three subadult individuals in which the general colour is dull grey ("mouse-grey"), the slaty bases of the hairs appearing more conspicuous than the brownish tips. This cold grey colour may, of course, be an immature character, but it seems more probable that it represents the true tint of the coat before bleaching has set in—more material is necessary before the point can be definitely settled.

Crocidura manni is easily recognized by its large size and pale cinnamon-grey or greyish colour. It would seem to be most nearly allied to *odorata* from the Gaboon.

Group 3 (*odorata* and *occidentalis*).

Size very large, large or medium. Colour above either greyish brown or sepia-brown, the latter usually bleaching to bright reddish or buffy brown. Second and third upper unicuspid about equal in size.

(3) *Crocidura odorata*, Leconte.

Sorex odoratus, Leconte, Proc. Acad. Nat. Sci. Phil. p. 11 (1857).

Size as large as in *manni*; skull long and with narrow interorbital region; tail less cylindrical.

The general colour is given by Leconte as "dark cinereous brown above inclining to chestnut, beneath slightly paler." The only specimen in the Museum Collection which can be identified with Leconte's species has been preserved in spirit for so long that the colour cannot be accurately described. Backs of hands and feet brownish. Tail less cylindrical, more slender and tapering than in *manni*, covered entirely with short brownish hairs; the caudal bristles in this spirit-specimen are not very numerous or conspicuous.

Skull large, about equal in length to that of *manni*, but more slender in the interorbital region and with a rather narrower brain-case.

Dimensions as given by Leconte :—

"Length 5 inches; head 1·65; tail 2·6; ear ·2."

Dimensions of spirit-specimen :—

Head and body 129 mm.; tail 81; hind foot 21; ear 11.

Skull of same specimen: condylo-incisive length 31; greatest breadth 12·9; least interorbital breadth 5·7; length of palate 14·6; postpalatal length 14·5; greatest maxillary breadth 10; length of upper tooth-row 15·2.

Hab. Gaboon, West Africa.

The only specimen in the collection which at all resembles Leconte's brief description is the one from Cette Cama, Gaboon, the dimensions of which have been given above.

This large species may be distinguished from *manni* by its browner colour, narrower skull, and less cylindrical and more tapering tail.

(4) *Crocidura occidentalis*, Puch.

Pachyura occidentalis, Pucheran, Rev. et Mag. Zool. p. 154 (1855); Arch. Mus. x. p. 124, pl. xii. (1861).

Pachyura æquatorialis, Pucheran, Rev. et Mag. Zool. p. 154 (1855); Arch. Mus. x. p. 127, pl. xii. (1861).

Crocidura petersi, Dobson, Ann. & Mag. Nat. Hist. (5) vi. p. 495 (1890).

Size fairly large, about as in *nyansæ*, smaller than either *manni* or *odorata*.

General colour (in bleached pelage) reddish brown ("Prout's brown"), slightly paler on the flanks. Underparts dull grey washed with buff; new unbleached fur dark sepia-brown ("clove-brown" mixed with "blackish brown (1)"), much darker than in the bleached state. Backs of hands and feet brownish. Tail brown above and below; caudal bristles fairly numerous.

Pucheran's preliminary diagnosis of this species is as follows:—"Supra rufescens, infra dilutior; cauda, basi crassi, tertiam corporis partem tantum superante." In 1861 a fuller description appeared in the 'Archives du Muséum,' in which the following information is given:—"L'individu qui nous a servi pour établir cette espèce, est roussâtre sur le dessus et les cotes de la tête, le dessus du cou, le dos et l'extérieur des membres. Les poils sont dans toutes ces parties, d'un cendré clair dans presque toute leur étendue, et roussâtre à leurs pointes. Le museau presque en entier est noirâtre. Sur les flancs et en dessous, depuis le menton jusqu'à la région anale, de même qu'à l'intérieur des membres, le fond de couleur, indiqué plus haut, devient plus terne et plus blanchâtre, par suite de l'affaiblissement des teintes dans le mode de coloration du poil..." It is evident from these descriptions that the individual on which *occidentalis* was founded was in the bleached coat, and not in the new dark sepia-coloured

pelage described above. In the Museum Collection there are some four specimens from the Gaboon, two in spirit and two skins; the latter are both in the red pelage. In a series of skins from the Ja River, Southern Cameroons, we find specimens both in the red and the dark new pelage; the contrast is so striking that a description of this animal would not be satisfactory without dealing with both phases.

The dimensions given by Pucheran are as follows:—

Length of head and body ("le lien passant sur le dos") 134 mm., ("directement prise") 82; tail 50.

The Gaboon spirit-specimens in the collection have the following dimensions:—

Head and body.	Tail.	Hind foot.	Ear.
mm.	mm.	mm.	mm.
100	70	17·5	11
102	64	18	10

The Cameroon series, which may also be accepted as *occidentalis*, present the following measurements:—

	Head and body.	Tail.	Hind foot.	Ear.
	mm.	mm.	mm.	mm.
♂	120	75	19	12·5
♂	130	82	19	12
♂	125	80	18	12
♂	120	77	19	12
♂	122	78	20	11
♀	115	65	17	12
♀	110	70	17·5	11
♀	120	77	17	13
♀	107	68	17	12·5

These measurements were all taken by the collector from the flesh; it will be seen that there is a very marked average difference in size between the two sexes, the males being considerably larger. This sexual variation is also exhibited in the skulls, as will be seen from the following figures:—

	Males			Females		
	(teeth unworn).			(teeth worn).		
	mm.	mm.	mm.	mm.	mm.	mm.
Condylar-incisive length	29	28·9	..	26·5	27·1	27·7
Greatest breadth	11·5	11·9	..	11·5	11·3	11·2
Length of palate	13	13	13·1	11·7	11·7	11·8
Postpalatal length.....	12	12	..	11·3	11·9	12
Greatest maxillary breadth ..	9·6	8·8	9	8·2	8·3	8·5
Length of upper tooth-row ..	13·5	13·4	13·7	12·1	12·2	12·3

The skulls of the two spirit-specimens from the type-locality give the following measurements :—

	♀ (teeth unworn).	♀ (teeth worn).
	mm.	mm.
Condyllo-incisive length	29·3	29·5
Greatest breadth	11·7	12
Length of palate	12·9	13·3
Postpalatal length	12·4	12·1
Greatest maxillary breadth	9·5	9·5
Length of upper tooth-row	13·7	13·6

There is, then, a certain amount of individual variation, as well as sexual variation in size, and this, combined with the great changes in colour which the pelage undergoes, makes the identification of the species a very difficult matter.

Hab. Gaboon.

The Gold Coast form, *spurrelli*, is the only one that might be mistaken for *occidentalis*, but the colour of the new pelage is never so dark as in the Gaboon species, and the latter has none of the silver-grey speckling so conspicuous in *spurrelli*.

(5) *Crocidura occidentalis spurrelli*, Thos.

Crocidura spurrelli, Thomas, Ann. & Mag. Nat. Hist. (8) vol. vi. p. 427 (1910).

Size rather larger than in *occidentalis*, but smaller than *manni*.

Hair short and close, much shorter and more velvety than in the large *Lagos* species.

General colour of unbleached coat dark sepia-brown sprinkled with silvery grey, resulting effect much as in "fuscous" mixed with "fuscous-black"; flanks a trifle paler, the tint gradually fading to the greyish buff of the underparts. In the bleached condition, just when the new dark fur is appearing, the general colour is very much lighter and redder ("snuff-brown"), more as in *nyansæ*; underparts in bleached specimens strongly tinted with brownish buff. Backs of hands and feet brownish. Tail cylindrical, appearing almost naked, clothed with minute blackish-brown hairs, slightly lighter on the ventral surface; caudal bristles slender and numerous.

Skull long and narrow, in size about as in *n. kivu*, much smaller than in *manni*, interorbital and maxillary region narrow; brain-case small. Unicuspid broader than in the *nyansæ* group, more circular in section.

Dimensions of the type and five other specimens from the type-locality (measured in the flesh) :—

	♀ (type).	♀.	♀.	♂.	♀.	♀.
	mm.	mm.	mm.	mm.	mm.	mm.
Head and body ..	115	129	127	137	140	140
Tail	70	73	63	70	68	65
Hind foot	19	19	18·5	20	19	19
Ear	11	12	12	12	12	12

Skull: dimensions of the type and three other thoroughly adult specimens :—

	♀ (type).	♀.	♀.	♂.
	mm.	mm.	mm.	mm.
Condilo-incisive length	29·8	30·2	31	31
Greatest breadth	11·2	11·8	12·1	11·9
Least interorbital breadth ..	5·2	5·5	5·3	5·5
Length of palate	13	13	13·1	13·8
Postpalatal length	12·7	13	13·3	12·7
Greatest maxillary breadth ..	9·3	9·6	9·6	10
Length of upper tooth-row ..	13·2	13·6	13·6	13·8

Hab. Bibianaha, Gold Coast.

Type. Adult female. B.M. no. 10.8.1.1.

The series of skins in the Museum Collection show an extraordinary amount of variation in general colour, the tint varying from dark sepia-brown in the unbleached pelage to bright reddish brown in the old faded coat. Similarly, the underparts vary from light silvery grey to brownish buff.

(6) *Crocidura occidentalis nigeriæ*, subsp. n.

Considerably smaller than either *occidentalis* or *spurrelli*, with much smaller skull.

Hind foot less than 17 mm. in length.

General colour (taken from spirit-specimen) appears much as in *occidentalis*, brownish above and below, the ventral surface rather paler and greyer. Backs of hands and feet brown. Tail cylindrical, fairly stout, covered with short dark brown hairs, rather lighter on the ventral surface; caudal bristles long and very numerous.

Skull smaller than that of *occidentalis* or *spurrelli*. Teeth considerably smaller.

Dimensions of type (measured from spirit-specimen) :—

Head and body 98 mm.; tail 67; hind foot 15·5; ear 9·5.

Skull: condilo-incisive length 26; greatest breadth 10·5; least interorbital breadth 5·2; length of palate 11·5; greatest maxillary breadth 8; length of upper tooth-row 11·5.

Hab. Asaba, 150 miles up the Niger.

Type. Adult male. B.M. no. 95. 5.3.2. Presented and collected by Dr. W. H. Crosse.

The very much smaller skull and teeth immediately separate this form from *occidentalis*, *spurrelli*, and *cara*. It is distinguished from the Liberian *büttikoferi* by its much longer tail and from the other Liberian species, *schweitzeri*, by its rather longer tail and larger skull.

(7) *Crociodura occidentalis cara*, subsp. n.

A long-tailed form with large hind feet and fairly long skull, allied to *schweitzeri*.

General colour rather dark, about as in "fuscous" mixed with "mummy-brown"; ventral surface greyer, but very little lighter ("deep neutral grey" washed with "wood-brown"), hairs of belly with grey bases and dull buff tips. Backs of hands and feet brown. Tail long, dark brown in colour, a shade lighter underneath; caudal bristles numerous.

Skull rather large with long palate and fairly large teeth.

Dimensions of the type (measured in the flesh):—

Head and body 106 mm.; tail 65.5; hind foot 18; ear 12.

Skull (occipital region broken): length from basioccipital suture to front of incisors 22.6; posterior border of lambdoidal crest to front of incisors 26.7; greatest breadth 11.3; least interorbital breadth 5.5; length of palate 12.3; greatest maxillary breadth 8.9; length of upper tooth-row 13.

Hab. Jala, Sierra Leone.

Type. Adult male. Original number 9. Collected by R. H. Bunting, Esq.

Mr. Bunting obtained two further specimens of this new shrew on Mt. Barclay, Liberia, both very like the type in general colour and proportions.

In the spirit-collection there is a further specimen which may be referred to this form, collected by Canon F. C. Smith in Sierra Leone. The following measurements are taken from these three specimens:—

	Head and body.	Tail.	Hind foot.	Ear.	Upper tooth- row.
	mm.	mm.	mm.	mm.	mm.
♂. Liberia	105	66	18	11	13.2
♂. Liberia	94	67	19	12	13.2
♂. Sierra Leone .	103	70	18	12	13.5

The larger size of the hind foot and longer tail distinguish this form from *schweitzeri* and *büttikoferi*.

(8) *Crocidura schweitzeri*, Pet.*Crocidura schweitzeri*, Peters, MB. Akad. Wiss. Berlin, p. 187 (1877).*Crocidura stampflii*, Jent. Notes Leyd. Mus. x. p. 47 (1887).Size rather less than in *occidentalis*.

Peters, in his preliminary diagnosis, describes this form as follows:—

“*Cr. cinnamomeo-fusca*, subtus pallidior, pilis basi schistaceis; cauda tetragona, setis longioribus in parte basali”

In the Museum Collection are three specimens from Sierra Leone, which agree fairly closely with Peters's description; the upper parts dull brownish or brownish cinnamon and the belly greyish or grey washed with brown, the latter being the older pelage, the condition described by Jentink for his *stampflii*, a form I am unable to distinguish from *schweitzeri*. Backs of hands and feet brownish white. Tail rather short, brownish above, lighter below; bristles light in colour and fairly numerous.

Dimensions (as given by Peters):—

Head and body 90 mm.; tail 53; hind foot (c. u.) 15; ear 10.

Length of upper tooth-row 10.3.

Hab. Liberia.

Dimensions of two specimens from Sierra Leone:—

Head and body 95, 85 mm.; tail 56, 48; hind foot 15, 15.5; ear 11, 10.

The dimensions of *stampflii* are very similar to those given by Peters:—

Head and body 94, 79 mm.; tail 60, 47; hind foot 15, 15; ear 10, 8.5.

The colour-difference is only such as might be due to the general darkening of the ventral surface, owing to the hair-tips becoming tinged with brown, as is so often the case in the worn pelage in this genus.

(9) *Crocidura büttikoferi*, Jent.*Crocidura büttikoferi*, Jentink, Notes Leyd. Mus. vol. x. p. 47 (1887).

Allied to *schweitzeri*, from which form it is distinguished by its much shorter tail.

Size of body rather less than in *schweitzeri*.

Jentink describes the colour as follows:—“Upper parts of the body brownish black coloured and the underparts

with silvery tips to the slaty hairs . . . ,” apparently very like the other members of this group.

Tail very short; no account is given regarding the tail-hairs.

In his remarks on the skull, Jentink mentions “a denticulation of the lower incisors”—a feature very often present in this genus, but more markedly so in *Sylvisorex*.

Dimensions of the type (taken from spirit-specimen) :—

Head and body 76 mm.; tail 40; hind foot 15 (c. u.); ear 7·5.

Hab. Robertsport, Liberia.

Type. Adult female in spirit.

The short tail readily separates *büttikoferi* from the rest of the *occidentalis* group. The exact relation which this form bears to the other members of the group is not at all clear.

[To be continued.]

XLVI.—On a small Collection of *Symphyla* from Algeria.

By RICHARD S. BAGNALL, F.L.S.

SOME little time ago Mr. S. Hirst, of the British Museum, submitted to me, along with other material, a collection of *Symphyla* made by himself in Algiers, and containing specimens of *ScutigereUa armata*, Hansen, which Mr. Hirst had already identified. I am also able to record an example of *S. immaculata* taken by Mr. P. A. Buxton of Trinity College, Cambridge.

GENUS SCUTIGEREUUA, Ryder.

This genus, as restricted in my memoir on the classification of the order (Journ. Linn. Soc., Zool. xxxiii. 1913, pp. 195–199), contains four species, which may be tabulated as follows :—

1. *Setæ* on legs more numerous, smaller, and less conspicuous; a series on inner side of metatarsus of hind leg present. *Setæ* on cerci rarely more than 0·18 to 0·2 mm. as long as the depth of cercus 2.

Setæ on legs fewer, longer, and more conspicuous; the metatarsus of hind leg with only one longish seta on the inner side at

- distal angle. Setæ on cerci 0·38 to 0·4 mm. as long as the depth of cercus. Length 3·0 to 3·5 mm. 3.
2. Size larger and more robust (4·5-8·0 mm.). Tibiæ of front pair of legs unarmed. *S. immaculata*, Newp.
 Size smaller. Tibia of front pair of legs each armed with a distinctive appendage on the inner margin near middle *S. armata*, Hansen.
3. 13th scutum normal, 14th scutum sparsely set with minute dorsal setæ. Setæ on legs longer; tibia, metatarsus, and tarsus of hind leg with 1, 3, and 4 (or 5) setæ on outer margin respectively. Legs not so stout *S. spinipes*, Bagn.
 Posterior margin of 13th scutum with a pair of flap-like processes; dorsal surface of 14th scutum devoid of setæ. Hind legs at least stouter and their seta shorter. Cerci shorter, broader, and more sparingly setose; tactile hairs unusually long and strong .. *S. bicutata*, Bagn.

Scutigerella immaculata (Newport).

Hamam Meskutin, E. Algeria, 1st April, 1913 (*P. A. Buxton*).

Scutigerella armata, Hansen.

Algiers, March 1911 (*S. Hirst*). Not yet recorded from outside Algeria.

Scutigerella spinipes, Bagnall.

A rare species, described in 1911 ("A Synopsis of the British Symphyla, with Description of new Species," Trans. Nat. Hist. Soc. Nd. & D'ham. ser. 2, vol. iv. pp. 17-41, pl. i.) from the North of England. This is the first record of its occurrence outside the British Isles. The claws of the Algerian specimen are slightly longer than described in the type-examples.

ALGIERS, March 1911, one example with eleven pairs of legs (*S. Hirst*).

Genus *SYMPHYLELLA* (Silv.), Bagn.

Symphylella vulgaris (Hansen).

ALGIERS, March 1911, one example (*S. Hirst*). I do not think that this species has been recorded previously from outside Europe.

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No. 90. JUNE 1915.

XLVII.—*Descriptions and Records of Bees.*—LXVII.
By T. D. A. COCKERELL, University of Colorado.

Paracolletes versicolor (Smith, 1853).

Mt. Wellington, Tasmania, 1300–2300 ft., Jan. 15–Feb. 6, 1913, 1 ♀, 2 ♂ (R. E. Turner). The female was described by Smith; the male is *P. spatulatus*, Ckll., 1905. In the same locality, at about the same time, Mr. Turner took a male *P. providellus bacchalis*, Ckll., var. *a*. Both species were described from the mainland of Australia.

Paracolletes pachyodontus,* sp. n.

♂.—Length 8–9 mm.

Black, with the mandibles red (except at extreme base), and the abdomen with approximately the lateral thirds of first three segments, as well as apical bands on the first four, deep chestnut-red; hair of head and thorax long and dull white, abundant on face, but vertex, mesothorax (except anteriorly), and most of scutellum with dark fuscous hair; a little fuscous hair below tegulæ; clypeus with sparse strong punctures; supraclypeal area prominent, smooth, and shining; antennæ short and thick, like those of a female, the flagellum red beneath; vertex strongly punctured; mesothorax finely and densely punctured, but glistening; postscutellum with a thick short median tooth; tegulæ piceous, punctured. Wings with the apical margin broadly dusky, stigma and nervures piceous; second s.m. small,

Ann. & Mag. N. Hist. Ser. 8. Vol. xv. 36

receiving first r. n. a little beyond middle. Legs black, with thin white hair. Abdomen shining, but the surface finely rugoso-punctate, first suture impressed; thin white hair on dorsal segments, but no bands; apical plate red, rounded.

Hab. Yallingup, S.W. Australia, Nov. 1913, three (R. E. Turner). British Museum.

A distinct species, somewhat related to *P. rhodopus*, Ckll., but recognizable at once by the colours, short antennæ, &c.

Paracolletes viridicinctus, Cockerell, 1905.

Eaglehawk Neck, Tasmania, Feb. 12–March 3, 1913 (R. E. Turner).

Paracolletes obscurus (Smith, 1853).

Mt. Wellington, Tasmania, 1300–2300 ft., Jan. 15–Feb. 6, 1913, three (R. E. Turner).

Nomia submærens, Cockerell, 1914.

Eaglehawk Neck, Tasmania, Feb. 12–Mar. 3, 1913 (R. E. Turner).

Euryglossa latissima, Cockerell, 1914.

This was described from the female, but three males are now before me, with the same data (Eaglehawk Neck, Tasmania; Turner). The male is somewhat smaller, and has the abdomen piceous, rufous at extreme apex. Otherwise there is no conspicuous difference, except that the antennæ are longer, and there is more long, loose, white hair about the face and mouth. The dark abdomen makes the male appear superficially like a distinct species.

Megachile tarsatula, sp. n.

♂.—Length about 6 mm.

Black, including the mandibles and long slender antennæ, but all the tarsi bright ferruginous; anterior tarsi simple, and coxæ with small short spines; head large and round, face with pale ochreous hair; clypeus with large punctures, with shining surface between, on upper part, but lower part with dense minute punctures; supraclypeal area very densely punctured; vertex with strong large punctures, and thin pale ochreous hair; mesothorax and scutellum finely and closely punctured (in complete contrast with vertex), the

surface between the punctures shining; thorax above with very thin and short pale ochreous hair, and no distinct sutural bands; area of metathorax granular at base and sides; tegulae rufo-piceous. Wings hyaline, dusky apically, stigma large, dark ferruginous. Legs with short pale hair. Abdomen finely and closely punctured, the bases of the segments deeply impressed; first segment with lateral pale apical hair-patches, third and fourth with conspicuous basal bands of glittering scale-like pubescence, fifth with the basal half thinly covered with pale hair, and sixth with even more, the hair pale ochreous-tinted and glittering; hind margins of second and following segments very narrowly fuscous; sixth segment vertical, the keel feeble, not or barely depressed in middle, a short tooth on each side of apical margin of segment.

Hab. Cuernos Mts., Negros, Philippine Is. (*Baker*, 3147, =type); Dapitan, Mindanao (*Baker*, 3139).

This minute species recalls some of the Australian forms, but does not resemble them in detail. I do not know any near relative. The small size and red tarsi readily distinguish it in the Philippine fauna.

Megachile indianorum, Cockerell, variety *a*.

A male from Jacksonville, Texas, at *Helenium tenuifolium*, Aug. 11, 1906 (*Bishopp*), represents a new variety with black legs. It differs in the pubescence and the colour of legs from Cresson's description of *M. deflexa*, but it is not improbable that both this insect and true *indianorum* represent varieties or races of *deflexa*. It also seems possible that *M. megalyra*, Cockerell, is the female of the present variety, although it has darker wings, and the strong coarse sculpture of the clypeus is entirely different. A female *M. megalyra* was taken at Ardmore, Okla, July 11 (*Jones*).

Megachile amica, Cresson.

The male closely resembles that of *M. integra*, Cresson, but is certainly distinct, being smaller, with no band in the suture between scutellum and metathorax, while the apex of the abdomen beneath presents a sharp median spine, wanting in *integra*. The curious claviform hairs beneath the white fringe on anterior tarsus are characteristic. The species, however, appears to be remarkably variable. One from Cotulla, Texas, on *Verbesina encelioides*, April 27, 1906 (*F. C. Pratt*), is scarcely 8.5 mm. long, and has the hair of

head and thorax above strongly ochreous. Another from Cotulla, at *Opuntia*, April 16, 1906 (*Pratt*), is of normal size, with the normal pallid hair. One from Victoria, Texas, April 27, 1907 (*J. D. Mitchell*), is of normal appearance, but differs from the Cotulla form by having the short stiff brush of hair near the base of the anterior basitarsus anteriorly dark fuscous instead of light orange.

The female of *M. amica* has remained unknown, but I recognized it with some confidence in specimens from Cotulla, at *Monarda punctata*, May 12, 1906 (*J. C. Crawford*) ; San Diego, Texas, April 23 (*Mitchell*) ; and Corpus Christi, Texas, at *Anogra pallida*, April 12, 1906 (*Pratt*). This female looks very much like *M. brevis*, but is especially to be recognized by the very long hairs standing out from the posterior border of the middle tarsus. The ventral scopa is white, black on last segment ; the last dorsal segment is somewhat concave in profile, and has coarse, but rather short, erect, black hair. The hair on the head and thorax above is white or slightly greyish, sometimes (San Diego specimen) largely fuscous on vertex. The clypeus is normal and densely punctured. The reference of this female to *amica* is strengthened by the occurrence of similar characters in the middle tarsi and scopa of *M. soledadensis*, Cockerell.

Megachile comata, Cresson.

Described from the male, but two females are before me, from Albuquerque, New Mexico, Aug. 1894 (*Snow*). The female is large and robust, about 16 mm. long ; ventral scopa pale yellowish, becoming white basally ; last dorsal segment with fine, erect, wholly pale hair ; when abdomen is seen from above, no black hair projects at sides ; hind basitarsus very broad ; mandibles quadridentate. There is no light hair-band in the suture anteriorly bounding scutellum.

Megachile candentula, sp. n.

♂.—Length a little over 7 mm.

Black, including the very long antennæ, mandibles, tegulæ, and legs ; wings strongly smoky, nervures and stigma rufo-piceous ; eyes dark brown ; face with short ochreous hair, not hiding surface, vertex with short sparse black hair, lower part of cheeks with long abundant pure white hair ; clypeus extremely densely punctured, with a slender smooth median line ; front dull, rugoso-punctate ; vertex with very large well-separated punctures ; mesothorax

and scutellum shining, with very strong distinct punctures and thin short black hair; pale hair-band in scutello-mesothoracic suture feeble or absent; postscutellum with rather long rufo-fuscous hair; area of metathorax shining; tubercles fringed with dense pale ochreous hair; pleura strongly and closely punctured, and with very thin pale hair. Legs ordinary, anterior tarsi simple and coxæ without spines; claws red with black tips. Abdomen short, the three segments closely and finely punctured, the fourth much smoother; first three with red marginal bands, evanescent in middle, on first reduced to lateral patches, fourth (except part of disc) and fifth covered with red pubescence, with scattered black hairs intermixed, the red is a deep orange-ferruginous; sixth segment retracted, with red hair at sides, its keel not at all prominent, feebly bilobed at apex; no apical (subventral) teeth or spines. Spurs of hind tibiae cream-colour.

Hab. Dapitan, Mindanao (*Baker*, 3140, 3144).

A distinct species, recalling by the colour of the abdomen *M. doanei*, Ckll., from Tahiti, but very different structurally.

Megachile hookeri, sp. n.

♀.—Length almost 15 mm.

Robust, black, including mandibles, tarsi, and antennæ. Wings hyaline, faintly dusky, with dark fuscous nervures; pubescence greyish white, long and black on vertex, on middle of mesothorax mixed with black, only a very few dark hairs on scutellum. Abdomen with pale hair on first two segments and basal part of third, but beyond that the hair is coarse, erect, and black, except that segments 3 to 5 have conspicuous entire white hair-bands, and the sixth, except basally, has a fine pale pruinose pubescence; sixth dorsal segment in outline concave, with the black bristles very large and conspicuous; ventral scopa entirely clear white. Mandibles broad, quadridentate, with long golden hairs arising from beneath the basal half; white hair of face and front abundant; clypeus minutely rugoso-punctate, but largely concealed by hair, its lower margin straight and shining; vertex with small punctures on each side of the ocelli, but more posteriorly with large punctures; mesothorax and scutellum closely punctured, disc of mesothorax more sparsely punctured, showing the shining surface; no white lines of hair on mesothorax and sutural band; b. n. falling short of t.-m.; anterior tarsi with a fringe of long

white hairs behind ; small joints of middle tarsi moderately thickened ; posterior basitarsi only moderately broadened.

Hab. Lehi, Utah, Sept. 9, 1905 (*W. A. Hooker*). U.S. National Museum.

Superficially just like *M. comata*, Cress. (♀ from Albuquerque, New Mexico ; *Snow*), but easily distinguished by the coarse black hair on apical part of abdomen above. In this feature it resembles *M. manifesta*, Cress., which is much smaller and otherwise different.

Megachile innupta, sp. n.

♀.—Length 12 mm.

Black, robust, with rather abundant silky greyish-white hair, forming entire and conspicuous bands on abdominal segments 3 to 5 ; clypeus with thin inconspicuous hair ; sides of vertex with a small amount of black hair ; hair of thorax above entirely clear white ; first two abdominal segments with copious white hair, third with thin pale hair in transverse sulcus, and short black hair between that and the apical band, fourth and fifth (except the bands) with short black hair, the fourth with a little pale basally, sixth with thin and rather short, erect, pale hair ; ventral scopa white basally, but clear ferruginous on the last two segments.

Mandibles broad, quadridentate, with golden hairs from the lower border ; clypeus strongly and densely punctured, with a thick, shining, essentially straight lower margin, but the sides of the margin broadly lobed or extended beyond the level of the central part ; antennæ black ; sides of vertex with large scattered punctures on a shining ground ; mesothorax densely punctured, smooth and shining in the anterior middle ; no lines of hair or sutural band ; tegulæ rufo-piceous. Wings hyaline, faintly dusky, nervures dark rufo-fuscous, b. n. falling short of t.-m. ; anterior tarsi very thick, with long glittering white hairs behind ; small joints of middle tarsi remarkably thick and short ; hind basitarsi much broadened ; all the claws with a well-developed basal tooth. Abdomen finely punctured, sixth dorsal segment in profile gently concave, without a distinct lip : when the abdomen is seen from above, there are no conspicuous dark hairs projecting laterally from the apical segments.

Hab. Pueblo, Colorado, Aug. 10, 1907 (*G. M. Hite*).

This looks much like *M. nupta*, Cress., but is easily separated by the lack of a distinct lip on the last dorsal segment, the much more swollen anterior tibiae, and the long hair on anterior tarsi behind. *M. nupta* has still shorter middle tarsi, the basitarsi being shorter. The clypeal

punctures of *nupta* are larger and not so dense. In the same locality, on the same day, Mr. Hite took *M. cleomis*, Ckll., ♀.

Megachile abluta subrixator, subsp. n.

♀.—Length 9 mm.

Agrees with the smaller form of *M. rixator*, Ckll., except that the clypeus has very large strong punctures, distinctly separated near the middle, and, while the median line is smooth, there is no keel. The end of the abdomen also differs, in that the last dorsal segment in lateral profile shows no evident erect hair and the last ventral segment has the hair entirely black. Ventral scopa very bright ferruginous, but white at base and black at apex; antennæ black; hair of head above reddish fuscous, of thorax above brownish ochraceous; conspicuous pale sutural bands in front and behind scutellum. Easily known from *M. abluta*, Ckll., by the much larger and less dense punctures of clypeus and the bright red ventral scopa.

Hab. Iligan, Mindanao, Philippine Is. (*Baker*, 3148 = type); Dapitan, Mindanao (*Baker*, 3142).

Males from Dapitan do not materially differ from *M. abluta*. The whole face is densely covered with pale golden hair. *M. abluta* and *M. rixator* were described from Formosa. Another small Philippine species (Luzon and Mindanao; *Baker*), named in manuscript by Friese, is very close to the Formosan *M. tranquilla*, Ckll.

Megachile bishoppi, sp. n. (*townsendiana*, subsp. ?).

♂.—Length about 10.5 mm.

Hair of head and thorax above pale yellowish; anterior coxæ spined; anterior tarsi simple. A species of the group of *M. parallela*, Sm., close to *M. townsendiana*, Ckll. (having keel of sixth abdominal segment curved downward), from which it differs thus: hair of face creamy (instead of pure white); thorax above very hairy, with only a very indistinct band in scutello-mesothoracic suture; keel of sixth abdominal segment smaller, less deeply emarginate, with the lobes on each side of the emargination much smaller.

Hab. Paris, Texas, May 24, 1904, two males (*F. C. Bishopp*). U.S. National Museum.

Megachile mendica coquilletti, subsp. n.

♂.—Length a little over 11 mm.

Pubescence pale greenish ochraceous; small joints of anterior tarsi light ferruginous; hair fringing anterior tarsi

behind very long ; no fuscous hair on thorax above ; keel of sixth abdominal segment jagged on each side of the rounded emargination ; apical teeth of abdomen five, the median one well developed, the lateral ones small, a trifle nearer to the sublateral than the sublateral are to each other. The abdomen has conspicuous dark hair on segments 3 to 5. The scutello-mesothoracic suture is wholly without a light band.

Hab. Los Angeles County, California (*Coquillett*). U.S. National Museum.

I describe this as a subspecies of *M. mendica*, but it is equally close to *M. brevis*, and until the female is known we cannot be sure which it should be associated with. Males collected by Snow in Arizona, which I consider to represent a variety of *brevis*, resemble *coquilletti* in their rather large size and ochreous hair, but they have dark anterior tarsi, and the keel of sixth segment only faintly crenulate on each side of the emargination.

Megachile penicillata, sp. n.

♀.—Long and narrow, with the general form and appearance of *M. occidentalis*.

Black, including the tarsi, mandibles, and antennæ ; wings strongly fuscous. Head large, rounded ; eyes prominent, chocolate-colour ; mandibles quadridentate (quinquedentate in *occidentalis*) ; labrum broad at apex, with two pencils of red hair directed forwards (vertically to plane of labrum) ; clypeus strongly subconfluently punctured, with a slender smooth median line, lower margin very broadly but shallowly excavated, or it could be described as straight, with a broad low lobe at each side ; sides of face, and region above and between antennæ, with copious greyish-white hair ; hair of clypeus extremely thin, but not fuscous ; region behind ocelli large, with strong quite close punctures ; mesothorax strongly and extremely densely punctured, with very short and sparse pale hair, but a pair of oblique bars of dense white hair (as in *occidentalis*, but not so large) in front, a light band along lateral margins, and a thin one in scutello-mesothoracic suture ; tubercles densely covered with creamy-white hair ; tegulæ rufo-piceous. Legs with white hair, pale yellowish on inner side of tarsi ; hind basitarsi very slender. Abdomen parallel-sided, strongly but not densely punctured, with narrow white hair-bands on the first four segments, that on first practically reduced to large triangular lateral patches ; sixth segment broadly hoary at

base, and without erect hairs; ventral scopa short and compact, pure white, black on last segment.

Hab. Trinity, Texas, Aug. 30, 1906, two (*F. C. Bishopp*). U.S. National Museum.

M. occidentalis, Fox, has the mesothorax much more finely punctured, and the last dorsal segment with a deep transverse subapical groove, represented only by a transverse depression in *penicillata*.

Bombus rufocinctus, var. *castoris*, n. n.

Bombus rufocinctus, Cress., var. 6, Franklin, Trans. Amer. Ent. Soc. xxxviii. p. 443.

♂.—Abdomen with yellowish-fulvous hair on first two dorsal segments, black on all the others.

Hab. Beaver Creek, Montana, 6300 ft., Aug. 1913 (*S. J. Hunter*). The abdomen is coloured as in the male of *B. vagans*, Smith. There is much yellow hair on the head above, and a large yellow patch in the middle of the face.

XLVIII.—*Notes on Fossorial Hymenoptera*.—XVI.

By ROWLAND E. TURNER, F.Z.S., F.E.S.

On the Thynnidæ, Scoliidæ, and Crabronidæ of Tasmania.

THE following list includes all the known species of Thynnidæ, Scoliidæ, and Crabronidæ occurring in Tasmania. I have already published notes on the Mutillidæ of the island (*Ann. & Mag. Nat. Hist.* (8) xiv. pp. 429-450), and hope at a future date to give a list of the Psammocharidæ. I have not included the few species known from the islands in Bass Straits, which are politically part of Tasmania. The fossorial Hymenoptera are not very numerous in Tasmania, and a considerable number are common to Australia and Tasmania, the resemblance to the fauna of the mountainous districts of S.E. Australia being very marked. The absence of the conspicuous coloration of broad orange bands, so characteristic of Australia, is remarkable; I am not aware that this plan of colour occurs among the wasps of Tasmania, except in one or two strong-flying Psammocharidæ which have doubtless found their way across from the mainland. In one case, *Crabro tridentatus*, Sm., which occurs in Victoria, has broad orange bands on the abdomen; the Tasmanian form, *C. tasmanicus*, Sm., has narrow yellow bands, but does not differ appreciably in structure.

Family *Thynnidae*.Subfamily *DIAMMINÆ*.*Diamma bicolor*, Westw.

Diamma bicolor, Westw. Proc. Zool. Soc. London, iii, p. 53 (1835). ♀.
Psammatha chalybea, Shuck. Trans. Ent. Soc. London, ii, 1, p. 69
 (1837). ♂.

Tachypterus fasciatus, Guér. Voy. Coq., Zool. ii, 2, p. 217 (1839). ♂.

Not uncommon in Northern Tasmania, but I did not take specimens in the south. Also common in the south-eastern portions of Australia from Adelaide to Sydney.

Subfamily *RHAGIGASTERINÆ*, Ashm.*Rhagigaster pugionatus*, Sauss.

Rhagigaster pugionatus, Sauss. Reise Nov. Zool. ii., Hym. p. 113
 (1867); Turn. Proc. Linn. Soc. N.S.W. xxxii. p. 234 (1907). ♀.

Common on *Leptospermum* blossom at Eaglehawk Neck in February. I have had a specimen of this species from Cumberland, N.S.W., but it is certainly not common on the mainland. I do not know that any other species of the genus occurs in Tasmania, though forms of *R. unicolor*, Guér., are so plentiful on the mainland. Westwood, however, mentions a specimen of *R. unicolor* sent to him as coming from Tasmania. I therefore include it as Tasmanian, though with doubt.

Rhagigaster unicolor, Guér.

Rhagigaster unicolor, Guér. Voy. Coq., Zool. ii, 2, p. 214 (1839). ♂.
Rhagigaster binotatus, Westw. Arc. Ent. ii. p. 105 (1844). ♀.

If any form of this occurs in Tasmania, it would probably be the Victorian subspecies *lyelli*, Turn.

Genus *EIRONE*, Westw.*Key to the Tasmanian Species.*

♂ ♂.

1. Clypeus without an apical depression or triangular truncation; legs black 2.
 Clypeus with an apical depression or triangular truncation; legs ferruginous or bright testaceous brown 3.
2. Pronotum entirely black *E. dispar*, Westw.

- Anterior and posterior margins of the pronotum narrowly white *E. exilis*, Turn.
3. Pronotum and abdomen black..... *E. lucida*, Sm.
- Pronotum marked with yellow on the anterior margin at least; abdomen bright ferruginous, sometimes more or less clouded with black..... 4.
4. Antennæ yellow from the middle of the ninth joint of the flagellum to the middle of the twelfth..... *E. celsissima*, Turn.
- Antennæ black or ferruginous..... 5.
5. Antennæ ferruginous; apical depression of clypeus arcuate *E. leai*, Turn.
- Antennæ black; clypeus with a triangular surface from before the middle . *E. ichneumoniformis*, Sm.

♀ ♀.

- First abdominal segment not narrowed to the base; sixth dorsal segment with a carina *E. dispar*, Westw.
- First abdominal segment narrowed to the base; sixth dorsal segment without a carina *E. celsissima*, Turn.

Eirone exilis, sp. n.

♂. Black; the mandibles (except at the apex), the anterior and posterior margins of the pronotum narrowly, a spot on the tegulæ, the fore tibiæ in front, and a spot at the base of the intermediate and hind tibiæ white. Wings hyaline, iridescent, nervures fusco-ferruginous. A small spot on each side above the base of the antennæ white. Clypeus slightly emarginate at the apex, with a carina from the base not quite reaching the apex. Head finely and closely punctured, a deep oval depression in the middle of the front, above the interantennal prominence. Thorax closely punctured, most finely on the pronotum, scutellum very broadly rounded at the apex; median segment rounded, shining and sparsely punctured at the base, more closely elsewhere. Abdomen shining, sparsely and very shallowly punctured, the segments not depressed at the base, the apical dorsal segment more deeply punctured and narrowly rounded at the apex. Second abscissa of the radius as long as the third, the second recurrent nervure received just before the middle of the third cubital cell.

Length 8 mm.

Hab. Eaglehawk Neck, S.E. Tasmania; February.

This is allied to *inconspicua*, Turn., and less closely to *parca*, Turn., and *montivaga*, Turn., but differs from all of them in the carinated clypeus as well as in colour.

Eirone dispar, Westw.

Eirone dispar, Westw. Arc. Ent. ii. p. 144 (1844). ♂ ♀.

? *Thynnus* (*Agriomyia*) *brevicornis*, Sm. Cat. Hym. B.M. vii. p. 39 (1859). ♂.

Common on *Leptospermum* blossom in February at Eaglehawk Neck. Westwood's specimens were from Adelaide, but I do not think there is any specific difference.

Eirone ichneumoniformis, Sm.

Thynnus (*Agriomyia*) *ichneumoniformis*, Sm. Cat. Hym. B.M. vii. p. 39 (1859). ♂.

Eirone (*Lepteirone*) *ichneumoniformis*, Turn. Proc. Linn. Soc. N.S.W. xxxii. p. 252 (1907). ♂ ♀.

Hab. Hobart (*Lea*). Also from Victoria.

The triangular area on the clypeus does not quite extend to the apex, as stated in my description of the species, the apex being narrowly transversely depressed.

Eirone celsissima, Turn.

Eirone celsissima, Turn. Proc. Linn. Soc. N.S.W. xxxviii. p. 609 (1914). ♂ ♀.

The male is easily recognized by the yellow colour of the four apical joints of the antennæ. It is much larger than the other Tasmanian species of the genus.

Hab. Mt. Wellington, 2200 ft.; January to March. Waratah (*Lea*).

Eirone lucida, Sm.

Thynnus (*Agriomyia*) *lucidus*, Sm. Cat. Hym. B.M. vii. p. 36 (1859). ♂.

The female is unknown, but probably resembles that of the closely allied form *E. lucidula*, Turn., which represents the present species on the mainland.

Hab. Eaglehawk Neck; February.

Eirone leai, sp. n.

♂. Black; the mandibles (except at the apex), clypeus, a line on each side on the anterior margin of the pronotum, and a spot at the apex of the anterior tibiæ yellow; the antennæ (except the three apical joints), a line on the inner margin of the eyes, the legs (except the coxæ), and the abdomen rufo-ferruginous; tegulæ fusco-testaceous; wings subhyaline, nervures fuscous.

Length 8-12 mm.

♂. Clypeus broad, with a broadly arched carina near the

middle, the apical portion below the carina strongly depressed and subconcave, truncate at the apex. Antennæ long, as long as the head, thorax, and median segment combined, the apical joints arcuate beneath; interantennal prominence bilobed. Head not much produced or narrowed behind the eyes; the posterior ocelli as far from the eyes as from the posterior margin of the head. Finely and closely punctured, most finely on the median segment; abdomen elongate-fusiform, sparsely punctured. Hypopygium small, rounded at the apex, and ciliated. Third abscissa of the radius shorter than the second by about one-fifth, second recurrent nervure received just before the middle of the third cubital cell.

Hab. Waratah, N.W. Tasmania (*Lea*).

Described from four males.

This is nearest to *E. rufopicta*, Sm., but in that species the clypeus is longitudinally carinate before the apical depression. The clypeus also distinguishes it from *caroli*, Turn., and other allied species.

Subfamily THYNNINÆ.

Ariphron bicolor, Erichs.

Ariphron bicolor, Erichs. Arch. f. Naturgesch. viii. p. 264, t. v. fig. 1 (1842). ♀.

Ariphron rigidulus, Turn. Proc. Linn. Soc. N.S.W. xxxii. p. 274 (1907). ♂.

Hab. Eaglehawk Neck; February. Also from Victoria.

The female seems scarce, and I did not take it. From the localities in which I took the males I suspect that the females may associate with ants of the genus *Myrmecia*.

Tachynomyia abdominalis, Guér.

Agriomyia (Tachynomyia) abdominalis, Guér. Mag. de Zool. xii. p. 5 (1842). ♂.

Var. *Agriomyia (Tachynomyia) spinolæ*, Guér. Mag. de Zool. xii. p. 6 (1842). ♂.

Thynnus fervidus, Erichs. Arch. f. Naturges. viii. p. 263 (1842). ♂.

Tachynomyia abdominalis, Turn. Proc. Linn. Soc. N.S.W. xxxii. p. 279 (1907). ♂ ♀.

Hab. Mt. Wellington, 2200 ft.; January. Also from Victoria.

As far as I am aware, no other species of *Tachynomyia* occurs in Tasmania, though several are found in Victoria. The female is distinguished by the sculpture of the second dorsal segment, which is without the transverse rugæ usual in the genus.

Genus PHYMATOTHYNNUS, Turn.

Key to the Tasmanian Species.

♂ ♂.

- Tibiae and tarsi ferruginous; mandibles, apex of clypeus, lines on pronotum and on post-scutellum yellow *P. derelictus*, Turn.
 Entirely black *P. monilicornis*, Sm.

♀ ♀.

- Pronotum much longer than wide, not subcarinate in the middle posteriorly *P. derelictus*, Turn.
 Pronotum only a little longer than broad, subcarinate in the middle on the posterior half *P. monilicornis*, Sm.

Phymatothygnus monilicornis, Sm.

Thynnus (*Agriomyia*) *monilicornis*, Sm. Cat. Hym. B.M. vii. p. 39 (1859). ♂ ♀.

This was described from Victoria, but there is a pair in the British Museum from Tasmania sent by Mr. A. Simson probably from the Launceston district. I did not see the species in Southern Tasmania.

Phymatothygnus derelictus, sp. n.

♂. Black, with light fulvous pubescence; the mandibles (except at the apex), the apical margin of the clypeus broadly, the margin of the interantennal prominence narrowly, a line on each side on the anterior margin of the pronotum, and a spot on the postscutellum pale yellow; tegulae testaceous; the tibiae, tarsi, and the apex of the femora ferruginous. Clypeus convex, without a distinct carina, produced and very narrowly truncate at the apex. Head finely and very closely punctured, the interantennal prominence fairly well developed and very broadly rounded at the apex, a short and shallow longitudinal sulcus on the front. Thorax and median segment finely and closely punctured; abdomen shining and very shallowly punctured, flattened, the segments very slightly constricted at the base, the basal segment slender, very narrow at the base, half as broad at the apex as the apex of the second segment. Hypopygium longer than broad, very slightly widened from the base, tridentate at the apex, the central tooth long, the lateral ones short but distinct. Wings subhyaline, nervures fuscous; second recurrent nervure received just before one-fourth from the base of the third cubital cell.

Length 12 mm.

♀. Fusco-ferruginous, more or less stained with black, especially on the apical abdominal segments.

Head closely and not very finely punctured, broader anteriorly than long, much narrowed posteriorly, the antennæ inserted far apart, the front produced between them and subtuberculate on each side. Pronotum convex, distinctly margined laterally, nearly half as long again as the greatest breadth; scutellum longer than broad; dorsal surface of the median segment about half as long as the pronotum, very sparsely punctured. Second dorsal segment coarsely transversely rugulose, with a transverse carina near the base and another at the apex; the dorsal segments punctured, more closely on the apical segments. Sixth dorsal segment with a carina from the base almost reaching the apex, not compressed, rounded at the apex, the edges of the ventral segment produced upwards and forming marginal carinæ along the apical half of the dorsal segment.

Length 9 mm.

Hab. Eaglehawk Neck; February. Ferntree, Mt. Wellington; January.

Both sexes are very near *P. monilicornis*, but the male differs in the presence of yellow markings, in the colour of the legs, in the absence of a carina at the base of the clypeus, and in the greater development of the spines on the hypopygium. The female differs in the longer pronotum, which is also subcarinate longitudinally on the posterior half in *monilicornis*, also in the margins of the sixth ventral segment. These differences I think are specific, though the species are very closely related.

Psammothynnus depressus, Westw.

Thynnus (Agriomyia) depressus, Westw. Arc. Ent. ii. p. 107 (1844).
♂ ♀.

There is a specimen of this species in the British Museum taken by Commander Walker at Hobart. The type was taken at Albany, W.A.

Genus ASTHENOTHYNNUS, Turn.

Key to the Tasmanian Species.

♂ ♂.

Legs and abdomen black marked with pale yellow; hypopygium slightly broadened from the base and truncate at the apex, with a median spine *A. westwoodi*, Guér.

Legs and usually abdomen also bright rufo-testaceous; hypopygium gradually produced into a long spine *A. maritimus*, Turn.

♀ ♀.

Anterior margin of the pronotum not raised; the elevated portion of the first dorsal segment before the depressed apical margin with a distinct median emargination *A. westwoodi*, Guér.

Anterior margin of the pronotum raised, forming a marginal carina; elevated portion of first dorsal segment not emarginate, almost straight on the posterior margin *A. maritimus*, Turn.

Asthenothynnus westwoodi, Guér.

Agriomyia westwoodi, Guér. Mag. de Zool. p. 4 (1842). ♂.

Thynnus intricatus, Sm. Cat. Hym. B.M. vii. p. 30 (1859). ♂.

Thynnus longiceps, Sm. Cat. Hym. B.M. vii. p. 46 (1859). ♀.

Thynnus nanus, Sm. Descr. New Sp. Hym. p. 171 (1879). ♂.

Hab. Fern-tree, Mt. Wellington; January. Eaglehawk Neck; February. Also from Victoria and New South Wales.

This is a common Tasmanian species. Guérin's type was from Tasmania, also the types of *intricatus* and *longiceps*. The type of *nanus* also came from Tasmania.

Asthenothynnus maritimus, sp. n.

♂. Black; legs (except the coxæ) and abdomen (except the base of the first segment) bright rufo-testaceous; mandibles, anterior margin of the clypeus, inner margin of the eyes, margins of the pronotum, a large spot on the mesopleuræ, a spot on the tegulæ and a curved line above them, a small spot on the posterior margin of the mesonotum, a longitudinal mark on the scutellum, a transverse band on the postscutellum, and a spot on the sides of the median segment near the apex yellow; a spot on each side on the vertex near the summit of the eyes dull ferruginous red.

Head and thorax closely and finely punctured, clypeus with a short longitudinal carina from the base, the inter-antennal prominence only slightly developed, a very shallow groove on the front not reaching the anterior ocellus. Median segment with a shallow groove from the base not reaching the apex. Abdomen slender and somewhat flattened, the first segment much longer than the second, very slender at the base, the second at the apex half as broad again as the apex of the first. Sides of the hypopygium gradually convergent to the median spine. Wings hyaline, the third

abscissa of the radius a little longer than the second; the third cubital cell receives the second recurrent nervure at one-quarter from the base.

Length 10 mm.

♀. Blackish brown; mandibles, antennæ, and legs paler brown; pygidium reddish brown. Head shining, smooth, much narrowed posteriorly, nearly twice as broad anteriorly as posteriorly, clypeus without a carina; a very short and shallow frontal sulcus. Pronotum as long as broad, slightly narrowed posteriorly, the anterior and lateral margins distinctly raised, a median sulcus nearly reaching the posterior margin. Scutellum a little longer than broad, rounded at the apex. Abdomen sparsely punctured, the first dorsal segment narrowly depressed at the apex, the raised portion before the depression straight, not emarginate. Second dorsal segment with three strongly raised transverse carinæ, the apical margin also slightly raised, forming another lower carina. Pygidium elongate-ovate, the dorsal plate truncate at the apex and not reaching to the apex of the ventral segment.

Length 8 mm.

Hab. Eaglehawk Neck; February. ♂ ♀ *in cop.* Swansea (*Lea*).

A male from Eaglehawk Neck has the abdomen, except the seventh segment and the apex of the sixth, blackish brown.

Genus NEOZELEBORIA, Rohwer.

Key to the Tasmanian Species.

♂ ♂.

- | | |
|---|--------------------------------|
| Hypopygium narrowly truncate at the base of the apical spine; abdomen with lateral yellow spots | <i>N. proxima</i> , Turn. |
| Hypopygium rounded at the base of the apical spine; abdomen black, immaculate | <i>N. carinicollis</i> , Turn. |

♀ ♀.

- | | |
|--|--------------------------------|
| Pronotum flat, with a sulcus from the anterior margin to the middle | <i>N. proxima</i> , Turn. |
| Pronotum strongly elevated along the median line, the elevation broadened anteriorly; without a sulcus | <i>N. carinicollis</i> , Turn. |

Neozeleboria carinicollis, sp. n.

♀. Head fully half as broad again as long, very strongly rounded at the posterior angles, shining, sparsely punctured,
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with a short frontal sulcus. Pronotum narrower than the head, as long as broad, raised along the median line into a strongly elevated carina, which broadens to the anterior margin; the dorsal surface on each side of the carina slightly concave. Scutellum strongly rounded at the apex, nearly as long as broad; dorsal surface of the median segment more than half as long as the pronotum. Thorax and abdomen subopaque, finely and very closely punctured; first dorsal segment with a transverse groove before the raised apical margin; second dorsal segment with five strongly raised carinæ, including the raised apical margin; sixth dorsal segment elongate-ovate, with a median carina, not compressed laterally.

Black; the head ferruginous; flagellum and legs testaceous brown, second and sixth dorsal segments and all the ventral segments dark ferruginous.

Length 7-9 mm.

♂. Black; the mandibles (except at the apex), a transverse line (interrupted in the middle) on the anterior margin of the pronotum, and a spot on the postscutellum (sometimes almost obsolete) pale yellow. Wings hyaline, nervures fuscous.

Clypeus slightly convex, a little advanced in the middle and truncate broadly at the apex; interantennal prominence not much developed, only showing as a tubercle above the base of each antenna. Head and thorax closely punctured and thinly clothed with long grey pubescence; antennæ longer than the thorax and median segment combined. Abdomen shining, fusiform, the segments not constricted; hypopygium linguiform, rounded at the apex, with a small apical spine. Third abscissa of the radius nearly half as long again as the second; second recurrent nervure received at about one-quarter from the base of the third cubital cell.

Length 10-12 mm.

Hab. Hobart (*Lea*).

The pronotum of the female is very different to other species of the genus, in which a longitudinal sulcus is always present and no carina; but otherwise there is no remarkable difference. The sexes are not marked as taken coupled, but I have no doubt of the association. The female is the type.

Neozeleboria proxima, Turn.

Thynnus (*Zeleboria*) *proximus*, Turn. Proc. Linn. Soc. N.S.W. xxxiii. p. 99 (1908). ♂ ♀.

Hab. Leura, N.S.W. Eaglehawk Neck; February

A common species. As in some other forms, this species ranges into the mountain-districts of S.E. Australia.

Agriomyia odyneroides, Westw.

Thynnus (Agriomyia) odyneroides, Westw. Arc. Ent. ii. p. 109 (1844).
♂ ♀.

Hab. Hobart (*J. J. Walker*).

This is very near *A. maculata*, Guér., but differs in the shape of the head and pronotum in the female, as well as in the markings on the median segment in the male. It must therefore be regarded as distinct, and not as a mere variety. The males in *Agriomyia* are very difficult to separate when the females are not available, owing to the want of good structural differences, and until we have long series it is not well to depend too much on colour-distinctions. Unfortunately species of this group are not taken coupled nearly so frequently as most Thynnidae.

Westwood does not give any locality for *odyneroides*, but most of the specimens I have seen are Tasmanian. There are also males in the British Museum from Adelaide, from Jindabyne, N.S.W., 3000 ft., and from "Moreton Bay." All these have the third abscissa of the radius distinctly longer than in Tasmanian specimens.

Thynnoturneria decipiens, Westw.

Thynnus decipiens, Westw. Arc. Ent. ii. p. 105 (note), p. 124 (1844).
♂.

Hab. Hobart (*J. J. Walker*).

Tmesothynnus humilis, Erichs.

Thynnus humilis, Erichs. Arch. f. Naturges. viii. p. 264 (1842). ♀.

♂. Black; a spot at the base of the mandibles, the lateral and apical margins of the clypeus narrowly, a line on each side at the anterior angles of the pronotum, a spot on the tegulæ, and a line on the postscutellum pale whitish yellow; the posterior margin of the pronotum luteous. Clypeus convex, smooth at the apex; head and thorax finely and very closely punctured, the interantennal prominence only slightly developed; scutellum strongly convex. Median segment rounded, shining at the base, finely punctured. Abdomen sparsely punctured, shining, the segments strongly constricted at the base, the apical segment strongly punctured, the apical

margin raised and slightly produced in the middle; hypopygium tridentate, the lateral teeth short, the margin between them almost straight except where produced into the long apical spine. Wings hyaline, nervures blackish. Second recurrent nervure received by the third cubital cell at a distance from the base equal to a little more than one-third of the length of the second transverse cubital nervure.

Length 9 mm.

Hab. Eaglehawk Neck; February. Hobart.

A variety of the female has the head red. The continental form of this species seems to be *T. truncatus*, Sm., but in that species the clypeus is less convex and more strongly punctured at the apex; the three spines of the hypopygium are much less developed, the lateral ones being almost obsolete, the apical dorsal segment is not produced in the middle of the apical margin, and the abdomen is more closely punctured. Females taken at Eaglehawk Neck have the head less punctured than would be expected from Erichson's description, but I think my identification is correct. A female from Hobart has the head red.

Hemithynnus olivieri, Erichs.

Thynnus olivieri, Erichs. Arch. f. Naturges. viii. p. 262 (1842). ♂ ♀.

Thynnus hyalinatus, Westw. Arc. Ent. ii. p. 106 (1844). ♂ ♀.

This species is also found in the mountainous regions of S.E. Australia.

The name *olivieri* has priority, and should be used in preference to *hyalinatus*. Erichson gives *apterus*, Oliv., as the name for the female of his species, but I think that name should apply to the female of *variabilis*, Kirby. This species is very close to *apterus*, which is so common in S.E. Australia, and may prove to be only a cool-climate form of that species; but I think it is distinct.

Lophocheilus niger, Sm.

? *Lophocheilus villosus*, Guér. Mag. de Zool. xii. p. 12 (1842). ♂.

Thynnus niger, Sm. Cat. Hym. B.M. vii. p. 30 (1859). ♂.

Lophocheilus villosus, Turn. Proc. Linn. Soc. N.S.W. xxxiii. p. 169 (1908). ♂ ♀.

Hab. Huon River (*Lea*). Eaglehawk Neck; February.

This species seems to be confined to Tasmania, where it is quite plentiful. It is represented in Victoria by an allied species, *L. anilitatis*, Sm. I am not at all sure that I was right in sinking Smith's name as a synonym of *villosus*,

Guér., and, as I have not seen Guérin's type, perhaps it is better to use Smith's name pending further information.

Thynnoides senilis, Erichs.

Thynnus senilis, Erichs. Arch. f. Naturges. viii. p. 263 (1842). ♂.

I have not seen this species from Tasmania, but I have received Victorian specimens answering to Erichson's description. I have no doubt that his record of the species as Tasmanian is quite correct.

Family **Scoliidae**.

Subfamily *ANTHOBOSCINÆ*, Turn.

Anthobosca flavicornis, Sauss.

Cosila (*Cullosila*) *flavicornis*, Sauss., Grandidier, Hist. Madagascar, xx. p. 233 (1892). ♀.

One female from Tasmania in the British Museum collection has the tibiae fulvous, not black as in the typical Australian form. It is also more sparsely punctured. Easily distinguished by the orange-yellow antennæ.

Anthobosca confusa, sp. n.

♀. Black, with sparse white pubescence, the spines of the tarsi testaceous brown. Wings hyaline, nervures black.

Clypeus shining, sparsely punctured, raised in the middle into a smooth longitudinal carina, which is broadened towards the apex. Head shining, sparsely punctured, almost as sparsely and finely on the front as on the vertex, no pubescence on the front. Thorax shining, very sparsely punctured, median segment shining, very minutely punctured. Abdomen shining, very shallowly and finely punctured, with sparse larger punctures. Sixth dorsal segment opaque, rather strongly punctured at the base, very minutely in the middle, the apical margin smooth and testaceous. The apical portion of the hind femora beneath is strongly rounded and broad, but there is no well-defined apical lobe. Radial cell broadly rounded at the apex, almost truncate; second abscissa of the radius scarcely longer than the first, the third longer than the first and second combined. First recurrent nervure received before the middle of the second cubital cell, second just before the middle of the third cubital cell. Tarsal ungues with a blunt basal lobe.

Length 7-12 mm.

♂. Opaque black; mandibles at the base, clypeus, posterior margin of the pronotum, tegulæ, a transverse spot on the postscutellum, and the tibiæ in front pale yellow; calcaria whitish. Wings hyaline, iridescent, nervures black.

Clypeus broad, almost transverse at the apex. Antennæ stout, a little shorter than the thorax and median segment combined. First abdominal segment distinctly, though only slightly, longer than the second, longer than its apical breadth, gradually widened from the base. Third abscissa of the radius as long as the first and second combined, the second longer than the first. The second recurrent nervure is received at two-fifths from the base of the third cubital cell, the first at the middle of the second cubital cell.

Length 6 mm.

Hab. Eaglehawk Neck; February. Mt. Wellington, 1300 ft.; January. Ulverstone (*Lea*).

Somewhat intermediate in the female between *unicolor*, Sm., and *levifrons*, Sm. From *unicolor* it differs in the absence of the strong puncturation of the front and the long hairs rising therefrom, also in the position of the second recurrent nervure; from *levifrons* in the puncturation of the head, in the broadening of the carina of the clypeus, in the absence of ferruginous colour on the mandibles and antennæ; and from both in the lesser development of the lobe at the apex of the hind femora.

The male differs from *frenchi*, Turn., in the longer first abdominal segment and the yellow clypeus, and from *lagardei*, Turn., in the same manner as to the first segment and also in the absence of yellow markings on the seventh dorsal segment.

My record of *unicolor*, Sm., from Tasmania (Proc. Zool. Soc. London, p. 734, 1912), applied to this species, but further material has convinced me that it is distinct.

The female is the type.

Scolia (Dielis) tasmaniensis, Sauss.

Elis tasmaniensis, Sauss. Mem. soc. phys. & hist. nat. Genève, xiv. p. 61 (1854). ♀.

Elis (Dielis) formosa, Sauss. et Sich. Cat. Sp. Gen. *Scolia*, p. 209 (1864).

♂ ♀; Turn. Ann. & Mag. Nat. Hist. (8) iv. p. 178 (1909) (nec Guérin).

I have not seen specimens of this common Australian species from Tasmania, but have no reason to doubt Saussure's record. It has usually been known under the name *formosa*, Guér., which is quite a different species, which does not range south of Cairns in North Queensland.

Family Crabronidæ.

Subfamily *PEMPHREDONINÆ*.*Spilomena hobartia*, Turn.

Spilomena hobartia, Turn. Proc. Linn. Soc. N.S.W. xxxviii. p. 622 (1914). ♀.

Hab. Eaglehawk Neck; March.

Taken on dead *Eucalyptus*-trees in which old beetle-holes were numerous. Doubtless this little wasp makes its nests in these abandoned holes.

Subfamily *SPHECINÆ*.*Chlorion (Harpactopus) globosus*, Sm.

Sphex globosus, Sm. Cat. Hym. B.M. iv. p. 251 (1856). ♂ ♀.

Harpactopus australis, Sauss. Reise 'Novara,' Zool. ii. p. 42 (1867).

Hab. Hobart (*Walker*).

I have taken this species as far north as Cooktown and also at Yallingup and Kalamunda in S.W. Australia. It probably ranges over the whole continent.

Chlorion (Isodontia) obscurellus, Sm.

Sphex obscurella, Sm. Cat. Hym. B.M. iv. p. 251 (1856). ♂ ♀,

Hab. Hobart (*Walker*).

This is very near the wide-ranging *nigellus*, Sm., but has the petiole distinctly shorter.

Sphex (Psammophila) suspiciosa, Sm.

Ammophila suspiciosa, Sm. Cat. Hym. B.M. iv. p. 214 (1856). ♀ ♂.

I have seen Tasmanian specimens of this species. It has a wide range in the southern and interior districts of Australia.

Subfamily *BEMBECINÆ*.*Bembex furcata*, Erichs.

Bembex furcata, Erichs. Arch. f. Naturges. viii. p. 266 (1842). ♂ ♀.

Hab. Eaglehawk Neck; February. Launceston (*Simson*).

This species ranges over the whole southern portion of Australia from Sydney to Perth. It appears to be uncommon in the west. No other species of the genus occurs in Tasmania.

Subfamily *PARANYSSONINÆ*.

Sphodrotes punctuosus, Kohl.

Sphodrotes punctuosus, Kohl, Ann. natur. Hofmus. Wien, iv. p. 189 (1889). ♂.

A single male taken in February on *Leptospermum*-blossom at Eaglehawk Neck. Kohl described the species from New South Wales, and I have seen specimens of the male from Mt. Kosciusko in the Australian Museum, but no female.

Sericophorus chalybæus, Sm.

Sericophorus chalybæus, Sm. Ann. & Mag. Nat. Hist. (2) vii. p. 32 (1851). ♀.

Tachyrrhostus cyaneus, Sauss. Mem. soc. phys. & hist. nat. Genève, xiv. p. 1 (1854). ♀.

Hab. Eaglehawk Neck; February.

Four females taken burrowing in sand.

Zoyphium iridipenne, Turn.

Zoyphium iridipenne, Turn. Ann. & Mag. Nat. Hist. (8) xiv. p. 356 (1914). ♀.

Hab. Eaglehawk Neck; February.

On *Leptospermum*-blossom.

Subfamily *CRABRONINÆ*.

Crabro (Solenius) tasmanicus, Sm.

Crabro tasmanicus, Sm. Cat. Hym. B.M. iv. p. 425 (1856). ♀.

Hab. Fern-tree, 1300 ft.

A pair taken on *Leptospermum*-blossom in January.

Genus *RHOPALUM*, Kirby.

Key to the Tasmanian Species.

♀ ♀.

- | | |
|---|------------------------------|
| 1. First abdominal segment shorter than the second; black, the trochanters yellow; length 5-6 mm..... | <i>R. frenchii</i> , Turn. |
| First abdominal segment as long as or longer than the second; trochanters black; length over 6 mm. | 2. |
| 2. Hind tibiæ distinctly spinose | 3. |
| Hind tibiæ not spinose | <i>R. eucalypti</i> , Turn. |
| 3. Three basal segments of abdomen bright red, tibiæ and tarsi yellow | <i>R. tricolor</i> , Sm. |
| Abdomen wholly black, tarsi more or less yellow, fore tibiæ only yellow on the outside . | <i>R. variitarse</i> , Turn. |

Rhopalum frenchii, Turn.

Crabro (*Rhopalum*) *frenchii*, Turn. Proc. Zool. Soc. London, p. 526 (1908). ♀.

Hab. Mt. Wellington, 2300 ft.; January to April. Eaglehawk Neck; February. Also from Victoria and S.W. Australia.

Burrowing by the roadside on Mt. Wellington.

Rhopalum variitarse, Turn.

Rhopalum variitarse, Turn. Ann. & Mag. Nat. Hist. (8) xv. p. 89 (1915). ♀.

Hab. Mt. Wellington, 2300 ft.; January. Eaglehawk Neck; February.

Rhopalum eucalypti, Turn.

Rhopalum eucalypti, Turn. Ann. & Mag. Nat. Hist. (8) xv. p. 90 (1915). ♀.

Hab. Eaglehawk Neck; March.

Rhopalum tricolor, Sm.

Crabro tricolor, Sm. Cat. Hym. B.M. iv. p. 394 (1856). ♂.

Crabro (*Rhopalum*) *militaris*, Turn. Proc. Zool. Soc. London, p. 523 (1908). ♂.

Var. *Crabro* (*Rhopalum*) *tricolor*, Turn. l. c. p. 524 (1908). ♂ ♀.

Hab. Mt. Wellington, 2200 ft.; January. Eaglehawk Neck; February.

A very common species in sandy districts.

Also from S.E. Australia.

Subfamily *LARRINÆ*.

Genus *LARRA*, Fabr.

Three species which may be referable to this genus have been taken in Tasmania, but of these I have only taken one myself, which I identify with much doubt as *Tachytes australis*, Sauss. One only of Saussure's species can be identified with any certainty, *L. femorata*, Sauss., a species with ferruginous legs.

Larra femorata, Sauss.

Tachytes femoratus, Sauss. Mem. soc. phys. & hist. nat. Genève, xiv. p. 20 (1854). ♂.

Larra femorata, Kohl, Verh. zool.-bot. Ges. Wien, xxxiv. p. 243 (1884).

This is given by Saussure as Tasmanian (Reise Nov., Zool. ii. p. 74). It is a very common species in North Queensland, and is also found at Sydney. Though I have not seen Tasmanian specimens, I have no reason to doubt the correctness of the record.

Larra australis, Sauss.

Tachytes australis, Sauss. Mem. soc. phys. & hist. nat. Genève, xiv. p. 19 (1854) (nec Sauss. 1867).

Larrada australis, Sauss. Mélang. Hym. ii. p. 69 (1854).

Hab. Eaglehawk Neck; March.

I am not sure that my identification of this species is correct. Saussure states that the median segment is as long as the mesonotum, but in my specimens it is distinctly longer. Saussure's figure, however, shows it longer than the mesonotum.

In my specimens the pronotum is sunk much below the mesonotum, the middle portion higher than the sides, in this respect approaching *Notogonia*, but the tarsal ungues are shorter than is usual in that genus.

Larra (?) *nigripes*, Sauss.

Larrada nigripes, Sauss. Reise Nov., Zool. ii. p. 74 (1867); Schulz, Zool. Ann. iv. p. 191 (1911).

Schulz gives a description of the specimen marked as the type of this species in the Geneva Museum. But Saussure's description is of a ♀, apparently without a head, whereas the specimen described by Schulz is a ♂, with a head. This causes doubt as to whether the specimen is really the type or whether the label may not have been accidentally shifted. Schulz is inclined to place the species in *Tachytes*, though carefully pointing out how it differs from that genus in the oval posterior ocelli, in the long median segment, and in the form of the pronotum. I formerly considered the species identical with *L. psilocera*, Kohl, but after Schulz's remarks on Saussure's collection, I do not feel that this can be maintained. I have no evidence that *L. psilocera* occurs in Tasmania. I have not seen any species answering to the description given by Schulz.

The localities given in the Reise d. Novara are not always reliable, and it cannot be considered at all certain that the present species is Tasmanian.

Genus TACHYSPHEX.

Key to the Tasmanian Species.

♀ ♀.

- | | |
|---|--------------------------------|
| 1. Median segment smooth | 2. |
| Median segment rugose-reticulate | <i>T. rugidorsatus</i> , Turn. |
| 2. Second joint of the flagellum longer than the third | <i>T. pacificus</i> , Turn. |
| Second joint of the flagellum equal to or shorter than the third | 3. |
| 3. Second joint of the flagellum equal to the third; pygidium strongly compressed laterally | <i>T. pugnator</i> , Turn. |
| Second joint of the flagellum shorter than the third; pygidium not compressed laterally. | <i>T. discrepans</i> , Turn. |

Tachysphex pacificus, Turn.*Tachysphex pacificus*, Turn. Proc. Zool. Soc. London, p. 491 (1908). ♀.*Hab.* Mt. Wellington, 2200 ft.; January. Eaglehawk Neck; February.

Originally described from Victoria.

The antennæ are rather slender, the second joint of the flagellum considerably longer than the third.

Tachysphex discrepans, sp. n.

♀. Black; the mandibles at the apex fusco-ferruginous; tegulæ testaceous brown; spines of the anterior tarsi testaceous.

Clypeus obliquely depressed from below the middle to the apex, shining and sparsely punctured. Head opaque, the antennæ rather stout, third joint of the flagellum longer than the second by about one-quarter; eyes separated on the vertex by a distance equal to about twice the length of the second joint of the flagellum; a distinct longitudinal frontal sulcus reaching the anterior ocellus, a strong depression on the vertex behind the posterior ocelli. Pronotum very much depressed below the mesonotum, almost vertical; thorax shining and only microscopically punctured. Median segment opaque, smooth, very broadly rounded at the apex, with a deep groove on the middle of the posterior slope. Abdomen shining, microscopically punctured, a band of white pubescence on each side of the apical margin of segments 1-3; apical segment not compressed laterally, elongate-triangular. First and third abscissæ of the radius about equal in length, the second distinctly longer, recurrent nervures separated by

a distance not quite equal to the length of the third abscissa of the radius. Spines of the fore tarsi long and slender.

Length 8-10 mm.

Hab. Eaglehawk Neck ; February. Mt. Wellington, 2200 ft. ; January.

This species is near *pacificus*, Turn., but may be distinguished by the stouter antennæ, the different proportions of the joints of the flagellum, the longer second abscissa of the radius, which is only equal to the first and third in *pacificus*, and by the shorter oblique depression of the clypeus. It is a smaller species than *pugnator*, Turn.

Tachysphex pugnator, Turn.

Tachysphex pugnator, Turn. Proc. Zool. Soc. London, p. 491 (1908). ♀.

Hab. Eaglehawk Neck ; February.

Originally described from Adelaide. Tasmanian specimens have the second and third abscissæ of the radius longer than in the type, but I do not consider this difference a specific one. The apical segment of the abdomen is strongly compressed laterally, the pygidial area being long and very narrow. The second and third joints of the flagellum are about equal in length, but are a little more slender in Tasmanian specimens than in the type.

Tachysphex rugidorsatus, sp. n.

♀. Black ; spines of the tarsi whitish ; an apical band of white pubescence on the sides of dorsal segments 1-3. Wings hyaline, iridescent, nervures black.

Clypeus minutely punctured, narrowly transversely depressed at the apex. Head opaque, finely and closely punctured, second joint of the flagellum nearly as long as the third, eyes separated on the vertex by a distance not quite equal to twice the length of the second joint of the flagellum, a deep depression on the vertex behind the posterior ocelli, a sulcus from the posterior ocelli almost reaching the occiput, no distinct frontal sulcus. Pronotum gradually sloped, not vertical, sunk below the mesonotum ; thorax finely and very sparsely punctured, the scutellum shining. Median segment rugose-reticulate, the sides finely striated. Abdomen shining, the apical segment not much compressed at the sides, elongate-triangular. Second abscissa of the radius as long as the first and third combined, first longer than the third. Recurrent nervures separated on the cubitus by a distance about equal to the first abscissa of the radius. Comb of the fore tarsi long and slender.

Length 8-9 mm.

Hab. Eaglehawk Neck ; February.

This is distinguished from *discrepans* by the sculpture of the median segment, the more distinct puncturation of the head and thorax, and the shorter third abscissa of the radius.

Tachytes tachyrrhostus, Sauss.

Tachytes tachyrrhostus, Sauss. Mem. soc. phys. & hist. nat. Genève, xiv. p. 18 (1854). ♂; Sauss. Reise Nov., Zool. ii. p. 73 (1867). ♂; Schulz, Zool. Ann. iv. p. 189 (1911). ♂.

This is a true *Tachytes*, as Schulz observes. I have a specimen of the male from Victoria, but have not myself seen Tasmanian specimens. There is a female in the British Museum from New South Wales.

Lyroda michaelsoni, Schulz, subsp. *tasmanica*, Turn.

Lyroda michaelsoni, Schulz, Fauna Sudwest Australiens, i. p. 479 (1908).

Lyroda michaelsoni, subsp. *tasmanica*, Turn. Proc. Linn. Soc. N.S.W. xxxviii. p. 621 (1914).

Hab. Eaglehawk Neck ; February.

Subfamily *NITELINÆ*.

Nitela nigricans, Turn.

Nitela nigricans, Turn. Trans. Ent. Soc. London, p. 428 (1910). ♀.

This is nearly related to *N. australiensis*, Schulz, from S.W. Australia, but differs in the smaller and shallower depressions round the base of the antennæ, in the lesser development of the carina on the front and clypeus, and in the wholly black anterior tibiæ. I doubt if these differences are more than of subspecific value.

Hab. Eaglehawk Neck ; March.

Taken on a fallen *Eucalyptus* log.

Subfamily *TRYPOXYLINÆ*.

Genus *PISON*, Jur.

Key to the Tasmanian Species.

- | | |
|---|-----------------------------|
| 1. Legs red | 2. |
| Legs black | 3. |
| 2. Three cubital cells ; posterior ocelli nearer to each other than to the anterior | <i>P. rufipes</i> , Schuck. |
| Two cubital cells ; ocelli in an equilateral triangle..... | <i>P. simulans</i> , Turn. |

3. Second recurrent nervure received by the second cubital cell; posterior ocelli separated from the eyes by a distance equal to less than half their diameter. Length under 9 mm. *P. westwoodi*, Shuck.
- Second recurrent nervure received by the third cubital cell or interstitial with the second transverse cubital nervure; posterior ocelli separated from the eyes by a distance fully equal to three-quarters of their diameter. Length about 14 mm. *P. spinolæ*, Shuck.

Pison rufipes, Shuck.

Pison (Pisonites) rufipes, Shuck. Trans. Ent. Soc. London, ii. p. 79 (1837). ♀.

Hab. Eaglehawk Neck; February. Mt. Wellington, 2200 ft.; January.

This species is also common throughout the southern portion of Australia.

Pison spinolæ, Shuck.

Pison spinolæ, Shuck. Trans. Ent. Soc. London, ii. p. 76 (1837). ♀.

Pison australis, Sauss. Mem. soc. phys. & hist. nat. Genève, xiv. p. 11 (1853).

Pison tasmanicus, Sm. Cat. Hym. B.M. iv. p. 316 (1856).

Hab. Eaglehawk Neck; February.

Also throughout S.E. Australia, as far north as Toowoomba.

Pison westwoodi, Shuck.

Pison westwoodi, Shuck. Trans. Ent. Soc. London, ii. p. 77 (1837). ♀.

Hab. Eaglehawk Neck; February; Mt. Wellington, 2200 ft.; January.

Shuckard states that the carina in the longitudinal groove on the median segment is obsolete in this species. In a series of twenty specimens collected by myself the carina is usually quite distinct near the base of the segment, but there is considerable variation in this character. I have recorded the continental form of this species as *P. iridipenne*, Sm. (Proc. Zool. Soc. p. 512, 1908), but the form of the clypeus differs in that Hawaiian species, being broadly and evenly rounded, whereas in *westwoodi* it is distinctly produced in the middle. The two forms are, however, very close. The posterior ocelli are nearer to the eyes in *iridipenne* than in typical *westwoodi*, but North Queensland specimens of *westwoodi* come very near *iridipenne* in this point. *P. westwoodi* is probably spread over the whole of Australia.

Pison (Parapison) simulans, sp. n.

♂. Black, opaque; the tibiae and tarsi ferruginous; the hind tarsi stained with black. Wings hyaline; nervures fuscous.

Clypeus produced into a short tooth in the middle of the apical margin; ocelli in an equilateral triangle, the posterior pair as far from each other as from the eyes; second joint of the flagellum no longer than the third. Pronotum on a level with the mesonotum, with a distinct dorsal surface. Median segment as long as the mesonotum, narrowed towards the apex, as long as broad, finely obliquely striated, with a deep median groove in which is a well-defined carina, the surface of the posterior slope almost smooth, with a deep median groove. Abdomen subopaque, minutely and closely punctured, the first segment longer than its apical breadth; the second segment distinctly constricted at the base. Two cubital cells only, the first abscissa of the radius twice as long as the second, first recurrent nervure received just beyond three-fifths from the base of the first cubital cell, second close to the base of the second cubital cell.

Length 6.5 mm.

Hab. Eaglehawk Neck; March.

Nearest to *Pison (Parapison) erythrocerum*, Kohl, but differs in the stronger sculpture of the median segment, in the colour of the femora and antennae, and in the much greater length of the second abscissa of the radius. Superficially it closely resembles *P. rufipes*, Shuck.

XLIX.—On Three new Bats obtained by Mr. Willoughby Lowe in the Sudan. By OLDFIELD THOMAS.

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DURING Mr. Abel Chapman's recent expedition to the Sudan, Mr. Willoughby Lowe obtained a considerable collection of mammals, and among them a number of bats. These include, besides *Coleura afra*, *Mops demonstrator*, and others, examples of the three following new species:—

Rhinopterus lowei, sp. n.

Larger than *R. floweri*; white instead of buffy below.

General characters as in *R. floweri*, but size, as gauged by

skull, distinctly larger. Colour apparently, judged by spirit-specimens, very much as in *R. floweri* above, but the whole under surface is entirely white, while in the type of *R. floweri* it is buffy, "light buff" posteriorly, and "warm buff" on the throat and chest.

Skull much larger than in *R. floweri*, the muzzle less shortened in proportion to the brain-case.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 40 mm.

Head and body 45; tail 36; ear 12.5; third finger, metacarpal 36.5, first phalanx 11.5; lower leg and hind foot (c. u.) 12.

Skull: greatest length 13.5; condyle to front of canine 12.9; zygomatic breadth 9; interorbital breadth 4.6; intertemporal breadth 3.2; palato-sinual length 5.3; front of canine to back of m^3 5.

Hab. Sudan. Type from the Blue Nile, 20 miles above Sennar.

Type. Adult male. B.M. no. 15. 3. 6. 70. Collected 13th December, 1913, by Willoughby P. Lowe.

Mr. Willoughby Lowe obtained five specimens of *Rhinopterus* at different localities on the Blue and White Nile. On examination of the skulls these prove all to belong to a larger form of the genus than *R. floweri*, living side by side with the latter in the same area—a phenomenon not unusual with the smaller bats. The *Rhinopterus* obtained by Dr. A. F. Wollaston at Shendi, and referred to in Anderson and de Winton's 'Mammals of Egypt,' also belongs to this larger form. Whether the difference in the colour of the under surface is constant remains to be seen.

Glauconycteris phalæna, sp. n.

Near *G. variegata*, but teeth smaller and incisors more slender.

Size as in *G. variegata*. Colour, of a spirit-specimen, apparently about as in that animal, the head and belly similarly whitish, but the back hardly so strongly buffy. The colour is therefore still further from that of the neighbouring *G. variegata papilio**, in which both head and belly

* I use this term for my *Glauconycteris papilio*, as I do not now think it should be specifically distinguished from *variegata*. The latter, however, in nature would simply appear to be a Damara desert race of the widely spread (Gambia to Beira) *papilio*, though the rules of nomenclature necessitate our putting the name the other way about.

are more or less strongly buffy. Wings strongly reticulated as in the allied species.

Skull essentially as in *variegata*, though the brain-case is perhaps, a little longer and narrower and the muzzle shorter but the difference is very slight.

Incisors smaller and lighter than in *variegata*; i^1 slender, unicuspid in the type, but the presence or absence of a secondary cusp in this group appears to be variable. I^2 considerably smaller than in *variegata*, not crushed between and touching i^1 and the canine in front and behind, but clearly separated from each of them. Molars distinctly smaller than in *variegata* and *papilio*, the combined length on outer edge of m^1 and m^2 in eleven specimens of those forms, including types of both, being 2.7–2.8 mm., while in the type of *phalæna* it is only 2.4 mm.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 44 mm.

Head and body 54; tail 44; ear 11.5; third finger, metacarpal 40, first phalanx 16; lower leg and hind foot (c. u.) 28.

Skull: greatest length 13.6; condylo-basal length 13.2; interorbital breadth 4.6; breadth of brain-case 8.1; palatosinual length 5; front of canine to back of m^3 4.8.

Hab. White Nile, near Fashoda.

Type. Adult female. B.M. no. 15. 3. 6. 67. Original number 71. Collected 27th January, 1914, by Willoughby P. Lowe.

Taphozous sudani, sp. n.

T. perforatus group. No gular sac. Feet comparatively large.

Size slightly greater than in *T. perforatus*. Distribution of fur about as in that species, except that the longer hairs are less extended on the thighs and interfemoral membrane. General colour above and below sepia-brown, the hairs white for their basal two-thirds. Wing-membranes whitish or white beyond a line connecting the elbow with the knee; rest of the membranes brown, more whitish below. No gular sac in male or female, nor any trace of it on the skin. Feet decidedly larger than in *T. perforatus*, about 13 mm. in length or upwards, as compared with about 11 mm. in the allied species. Wing-membrane inserted on the end of the tibia, instead of the ankle.

Skull in general like that of *T. perforatus*, but slightly

larger and the brain-case more swollen. Male skull decidedly larger than that of the female.

Dimensions of the type (measured on the spirit-specimen):—

Forearm 64 mm.

Head and body 71; tail 23; ear 17; third finger, metacarpal 58; first phalanx 21·5; lower leg and hind foot (c. u.) 39; hind foot only 13·5.

Skull: greatest length to base of canine 20·2; condyle to front of canine 19·7; interorbital breadth 6·1; breadth of brain-case 10; palato-sinual length 6·5; maxillary tooth-row 8·8.

Hab. Upper Nile. Type from Mongalla, just north of Lado; other specimens from Khartoum (*Major H. N. Dunn*) and Lake No (*Willoughby Lowe*).

Type. Adult male. B.M. no. 2. 7. 4. 2. Collected and presented by W. L. S. Loat, Esq.

This species is distinguishable from *T. perforatus* by its larger feet, more swollen brain-case, and whitened wing-membranes; from *T. hildegardeæ* by its smaller size, the absence of any gular beard, and generally darker colour.

L.—On the African Shrews belonging to the Genus
Crocidura.—II. By GUY DOLLMAN.

[Continued from p. 527.]

Group 4 (*hedenborgiana* and *nyansæ*).

Size very large or large. Colour above deep chocolate-brown, reddish brown, or pale buffy drab; ventral surface dark brownish or grey, never very distinctly marked off from the brown-tinted flanks; tail not sharply bicolor, lower side generally only a little paler than upper. Second and third upper unicuspid about equal in size.

(10) *Crocidura anchietæ*, Boc.

Crocidura anchietæ, Bocage, Journ. Sc. Lisb. p. 26 (1889).

About equal to *occidentalis* in size, but with shorter, less tapering tail and lighter underparts.

Colour above (from spirit-specimens) dark reddish brown, rather paler and greyer on the flanks; the lighter underparts not distinctly marked off from the brownish tint of the dorsal surface. Belly slate-grey washed with silvery cream, lighter than in *occidentalis*, but not as pale as in

flavescens. Backs of hands and feet brownish or dirty buff. Tail rather shorter and not tapering so markedly as in *occidentalis*, rather more coarsely haired, brownish above, a shade paler below; bristle-hairs fairly numerous, but inconspicuous.

Skull larger than in *flavescens*, about equal in size to that of *occidentalis*; tooth-row about the same, second and third upper unicuspid nearly equal in size, the second slightly broader and with a rather longer cusp than third. Last upper molar fairly large.

Dimensions (as given by Bocage) :—

Head and body 116 mm.; tail 63; hind foot 17.

Dimensions of co-type and topotype in the Museum Collection (in spirit) :—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♀ (co-type)	112	62	17	12
♀ (topotype)	107	63	17	11.5

Skulls of co-type (broken) and topotype: condylo-incisive length —, 30; greatest breadth —, 12.1; least interorbital breadth 5.7, 5.7; length of palate 12.9, 13; postpalatal length —, 13; greatest maxillary breadth 10, 9.8; median depth of brain-case —, 6.7; length of upper tooth-row 13.3, 13.2.

Hab. Caconda, Angola.

The co-type in the British Museum is an adult female. B.M. no. 89.5.1.2.

This species would appear to be somewhat intermediate between the *occidentalis* and *nyansæ* groups; it is probably most nearly allied to the *nyansæ* group, but until more up-to-date material is at hand for examination it is impossible to decide the exact affinities of this Angolan shrew.

(11) *Crocidura hedenborgiana*, Sund.

Sorex hedenborgianus, Sundevall, Vet.-Ak. Handl. Stock. p. 174 (1842).

Size much larger than in *fuscosa*, about as in *manni*; general colour very dark.

General proportions about the same as in *manni*; tail not exceptionally long. Hairs of back about 5 mm. in length, much shorter than in the long-haired *giffardi*.

Colour dark blackish chocolate ("aniline-black" mixed with "vandyke-brown"), a faint shade lighter on the ventral surface. This is the darkest of all the allied East-African

species, the general colour even darker than in the western *giffardi*. Feet and tail dark blackish, very much as in *fuscosa*; caudal bristles longer and more conspicuous. Sundevall describes the general colour as follows:—"Totum animale uno colore tinctum; saturate castaneo fuscum vel chocoladium, vel colore seminis-coffee ustae. Venter non pallidior; cauda et pedes paullulum nigriores."

Skull long and rather narrow, smaller than that of *giffardi*, more as in *manni*, but maxillary region not so expanded. Teeth large, second and third unicuspid about equal in size.

Dimensions of the type:—

Head and body 140 mm.; tail 52; hind foot 21.

Skull: upper tooth-row 15·3; three lower molars 6·4.

In the Museum Collection is a specimen of *hedenborgiana* from Roseires, on the Blue Nile; the dimensions of this individual are as follows:—

Head and body 118 mm.; tail 64; hind foot 20·4.

Skull: condylo-incisive length 33; greatest breadth 13·7; least interorbital breadth 6·5; length of palate 14·8; post-palatal length 14; greatest maxillary breadth 10·5; length of upper tooth-row 15·3.

Hab. Sennaar.

The very dark-coloured pelage and general dimensions of this shrew render it easily distinguishable from the other large East-African species.

(12) *Crocidura martiensseni*, Neum.

Crocidura martiensseni, Neumann, Zool. Jahrb. Abth. Syst. vol. vi. p. 544 (1900).

A very large species, equal in size to *manni*, but considerably darker in colour.

Colour of dorsal surface rich chestnut-brown. Lönnberg describes it as between burnt umber no. 2 and no. 4 (Plate 304, 'Rep. de Couleurs'). Ventral surface dark greyish washed with brownish.

Skull about equal in size to that of *hedenborgiana*, slightly narrower, and with rather smaller teeth.

Dimensions of the type:—

Head and body 140 mm.; tail 88; hind foot (c. u.) 24; ear 9.

Skull (dimensions of type-skull, published by Lönnberg): condylo-incisive length 33·3; greatest breadth 13·2; inter-orbital breadth 5·9; length of upper tooth-row 15·1.

Hab. Kilimanjaro and Usambara.

This large East-African shrew is probably most nearly related to *hedenborgiana*.

(13) *Crocidura fuscosa*, Thos.

Crocidura doriana fuscosa, Thomas, Ann. & Mag. Nat. Hist. (8) vol. xii. p. 90 (1913).

A dark chocolate-coloured species with black feet and tail, most nearly related to *hedenborgiana*, but rather lighter in colour and smaller.

General dimensions distinctly less than in Sundevall's species.

Colour of dorsal surface very dark chocolate (between "bistre" and "vandyke-brown") above and below, the ventral surface very slightly paler; hairs all with slate-grey bases and dark brown tips. Backs of hands and feet black, much darker than in any of the *nyansæ* group. Tail black above and below, more hairy than in *nyansæ*, with the caudal bristles black in colour and conspicuous. The skull of the unique type is unfortunately badly broken, only the brain-case, interorbital region, a portion of the maxilla, and mandible remaining. In size it is evidently smaller than in *hedenborgiana*, having a narrower brain-case and smaller teeth.

Dimensions of the type (measured in the flesh):--

Head and body 114 mm.; tail 60; hind foot 19; ear 12.

Skull (broken): greatest breadth of brain-case 12.7; combined length of three upper molars 4.8; of three lower molars 5.5.

Hab. Kaka, White Nile.

Type. Adult female. B.M. no. 1. 8. 8. 17.

This species was originally described by Thomas as a race of *doriana*; the great difference in general colour, the uni-coloured tail, and dark ventral surface seem to indicate that it must be considered as a form quite distinct from *doriana*. Its nearest relation would appear to be *hedenborgiana*, from which species *fuscosa* may be distinguished by its rather paler colour and smaller size.

(14) *Crocidura nyansæ*, Neum.

Crocidura flavescens nyansæ, Neumann, Zool. Jahrb. Abth. Syst. vol. vi. p. 544 (1900).

Considerably larger than the South African *flavescens*. Colour darker throughout.

General dimensions large, hind foot, in adult specimens, measuring 20 mm. in length.

Colour of dorsal surface browner than in *flavescens* (near "Saccardo's umber"), flanks rather paler; the brownish tint of the upper parts gradually passes into the dirty greyish brown of the belly, there being no sharp line of demarcation such as is found in the South-African species and *doriana*. Underparts slaty grey washed with either brown or dirty buff, the effect very conspicuously different from the cold grey-tinted belly of *flavescens*. Backs of hands and feet brown, usually about the same colour as the back or a little lighter. Tail brownish or brownish black above and below; in *flavescens* the tail is distinctly bicoloured, the ventral surface being markedly paler than the upperside.

Skull smaller than in *manni*, *odorata*, or *hedenborgiana*, about equal to that of *spurrelli*, but with a rather higher brain-case, the anterior portion not being depressed. Teeth a little larger; small upper unicuspid about equal in size.

Dimensions (as given by Neumann):—

Head and body 140 mm.; tail 66; hind foot 20.

Dimensions of a series of specimens in the Museum Collection (measured in the flesh):—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
♂. Entebbe	140	80	20	..
♀. Mumias	120	..	18	11
♀. "	115	78	19	8
♀. "	120	80	20	9
♀. Elgon	129	79	21	11
♀. "	124	76	18	12
♀. "	120	77	18	8
♀. Toro	122	91	20	12

Skull-dimensions of six adults:—

	♀. Elgon. mm.	♀. Elgon. mm.	♀. Elgon. mm.	♂. Entebbe. mm.	♀. Entebbe. mm.	♀. Mumias. mm.
Condylar-incisive length	32.5	30.5	30.6	30	30.5	30.5
Greatest breadth	13.2	12.3	12.2	12.6	12.8	12.3
Least interorbital breadth	5.8	5.5	5.8	5.5	5.4	5.6
Length of palate	14	13.2	13.3	13.4	13.6	13.4
Postpalatal length	14.4	13.3	13.2	12.7	12.7	13
Greatest maxillary breadth	10	9.8	9.9	9.2	9.9	9.4
Median depth of brain-case	7	6.8	6.9	6.7	7	7
Length of upper tooth-row	14.4	13.9	13.8	13.5	13.8	13.5

Such variation as exists in these dimensions would appear to be individual rather than sexual.

Hab. Ussoga, near exit of Nile from the Victoria Nyanza.

This form was originally described by Neumann as a race of the South African *flavescens*; on account of the great

differences in size, general proportions, colour, and cranial characters it seems best to consider *nyansæ* as a distinct species. We are thus able to deal with the large Central African shrews as a group apart from *flavescens* and its allies. In this *nyansæ* group we find the tail always unicoloured and not, as in *flavescens*, very much paler below than above. Further, there is in this group no distinct line of demarcation between the dorsal and ventral surfaces of the body, the transition from the brown-coloured upper parts to the brownish-grey ventral surface being very gradual and indistinct. In the Museum Collection is a fairly large series of specimens which may be taken as representing true *nyansæ*; this form would seem to be restricted to the country around the north end of the Victoria Nyanza. Mr. Kemp collected it at Kirui on Mt. Elgon, at Kagambah, and Mbarara, Uganda; there are also specimens from Entebbe, Mumias, Toro, and Mengo, Uganda.

(15) *Crocidura nyansæ kijabæ*, Allen.

Crocidura kijabæ, Allen, Bull. American Mus. Nat. Hist. xxvi. p. 173 (1909).

Very similar to *nyansæ*, but rather darker throughout.

In the original description Allen writes: "smaller size, relatively much longer tail"; the examination of a considerable series, both of *nyansæ* and the central British East African form, seems to indicate that such differences are individual and not of systematic importance; thus, if the figures given below be compared with the dimensions given by Allen and with the dimensions tabulated above for Neumann's species, it will be seen that *nyansæ* and *kijabæ* are of about the same size.

The colour-difference is not very marked, but, seen in a series, the general colour of the central British East African specimens is decidedly darker than the average colour of the *nyansæ* series.

Skull very like that of true *nyansæ*, both in size and dental characters.

Dimensions of the type (as given by Allen):—

Head and body 123 mm.; tail 78; hind foot 19.

Skull: condylo-incisive length 30; greatest breadth 12; interorbital breadth 5.2; length of upper tooth-row 14.

The following are the flesh-dimensions of eight adult specimens in the Museum Collection:—

	Head and body. mm.	Tail. mm.	Hind foot. mm.
♂. Jombeni	130	82	22
♂. Aberdare Mts.	126	81	20
♂. Mweru	123	79	20
♂. L. Olbollossat.....	120	81	19
♀. Mt. Kenya	123	82	22
♀. Nyiri	124	80	19
♀. Mt. Kenya	112	70	19
♀. L. Olbollossat	120	81	19

The following skull-dimensions are taken from the oldest individuals of this series:—

	♂. L. Olbollossat. mm.	♀. L. Olbollossat. mm.	♂. Mweru. mm.	♂. Jombeni. mm.	♀. Nyiri. mm.
Condyllo-incisive length	31·6	30	31·4	31·5	30·5
Greatest breadth	12·5	12	13	13	12·5
Least interorbital breadth ..	5·8	5·6	5·7	5·8	5·7
Length of palate	13·5	13·3	13·4	13·4	13·3
Postpalatal length.....	13·4	13·2	13·3	13·6	13·5
Greatest maxillary breadth ..	10	9·2	10·1	9·8	9·8
Median depth of brain-case ..	6·9	6·7	7·3	7·2	6·7
Length of upper tooth-row ..	14·1	13·7	14·1	14·1	13·6

From these dimensions it is evident that these specimens are of much the same size as Allen's type.

Hab. Kijabe, British East Africa.

Type. Adult female. American Museum of Natural History, No. 27890.

In the British Museum Collection there are specimens from the Aberdare Mountains, Kenya, Jombeni Range, Mweru, Nyeri, Lake Olbollossat, and Mianzini, which I have accepted as representing the Kijabe race.

(16) *Crocidura nyansæ kivu*, Osg.

Crocidula flavescens kivu, Osgood, Ann. & Mag. Nat. Hist. (8) vol. v. p. 370 (1910).

A very richly coloured race of *nyansæ*.

General proportions rather smaller, but not to any marked extent.

Dorsal surface a rich chocolate-colour ("light seal-brown" mixed with "vandyke-brown"), the general effect considerably darker than in both *nyansæ* and *kijabæ* and decidedly more glossy; flanks scarcely lighter than back. Underparts slate-grey strongly suffused with russet, there being no sharp transition between the brown-coloured belly and chocolate flanks. Backs of hands and feet as dark as rest of dorsal surface. Tail blackish, above and below, rather

darker than in *nyansæ*; caudal hairs as in the other members of this group.

The skulls of the series in the Museum Collection average rather smaller than in *nyansæ*, with smaller brain-case.

Dimensions of the type (measured in the flesh) :—

Head and body 110 mm.; tail 88; hind foot 19; ear 12.

The following are the average, maximum, and minimum flesh-measurements of thirty adult specimens in the Collection :—

	Head and body.	Tail.	Hind foot.
	mm.	mm.	mm.
Average	110·7	78	18·3
Maximum	119	88	20
Minimum	104	70	17

Skull: dimensions of type and six other adult specimens :—

	♂.	♂.	♂.	♂.	♀.	♀.	♀.
	Type.	Kivu.	Kivu.	Ruwen- zori.	Kivu.	Kivu.	Kivu.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Condylar-incisive length ..	30·8	29·7	30·6	29	29	28·9	29·3
Greatest breadth	12·3	12·2	11·9	11·8	11·5	11·7	11·6
Least interorbital breadth .	5·5	5·5	5·3	5·5	5·4	5·4	5·6
Length of palate	13·5	13·2	13·5	13	12·9	12·9	13·3
Postpalatal length	13	12·5	12·7	12·1	12·6	12·2	12·2
Greatest maxillary breadth .	9·2	9	9·3	9·2	9	9·2	9·1
Median depth of brain-case .	6·8	6·6	6·6	6·7	6·6	6·7	6·8
Length of upper tooth-row .	14·1	13·6	13·8	13·3	13	13·5	13

There is a considerable amount of individual variation in the skull-dimensions of this Kivu shrew; the typical specimen possesses a skull rather larger than any of the others, equalling in length some specimens of *nyansæ*.

Hab. Lake Kivu. Altitude 4900 feet.

Type. Adult male. B.M. no. 7. 6. 14. 24.

In the Museum Collection there are some thirty-five specimens of this Kivu shrew, all of which possess the same glossy, chocolate-coloured pelage and russet-tinted underparts. The localities where these specimens have been collected are for the most part quite close to the type-locality; Mr. Kemp obtained it at Buhamba, Mukanda, Kisenyi, Lake Mutanda, Kumba, and Chaya (Congo Belge), all districts fairly close to Lake Kivu. It has also been found on Ruwenzori (at altitudes of 5000–7000 feet) and at Ingezi and Nalasanji, Uganda.

C. nyansæ kivu may be at once recognized by its dark chocolate-coloured glossy coat, both *nyansæ* and *kijabæ* being lighter and exhibiting none of the glossy sheen so characteristic of this Kivu race.

(17) *Crocidura nyansæ tatiana*, subsp. n.

Smaller than *nyansæ*, with considerably smaller and shorter skull.

Size of body less than in the other members of this group; tail fairly long.

In colour very much as in *nyansæ*, dorsal surface liver-brown (near "Prout's brown"); flanks slightly paler, the brown tint gradually passing into the greyish buff of the ventral surface. Backs of hands and feet brownish buff. Tail blackish brown above and below, quite as in *nyansæ*, but rather shorter.

Skull considerably smaller, with much narrower cranium and smaller teeth.

Dimensions of the type (measured in the flesh):—

Head and body 100 mm.; tail 67; hind foot 18; ear 12.

Skull: condylo-incisive length 26.9; greatest breadth 11; least interorbital breadth 5.8; length of palate 11.5; postpalatal length 12.1; greatest maxillary breadth 8.7; length of upper tooth-row 12.3.

Hab. Mt. Gargues (sometimes spelt "Urguess"), north of the Mweru District, British East Africa. Altitude 7000 feet.

Type. Old female. B.M. no. 12.7.1.55. Original number 606. Collected on July 31st, 1911, by A. Blayney Percival, Esq., and presented by him to the British Museum.

This Guargues race of *nyansæ* is easily distinguished from the allied forms by its smaller size, a feature very evident when the skulls are examined.

(18) *Crocidura nyansæ zuleika*, subsp. n.

Allied to *nyansæ*, but with larger teeth and darker in colour.

General proportions of body about as in *nyansæ*; tail longer.

Colour of dorsal surface dull chocolate-brown ("warm sepia" mixed with "blackish brown (1)"), rather darker than in *n. kivu*. Flanks as dark as back. Ventral surface slate-grey washed with brownish buff; hairs of belly with pale slaty bases and long brownish-buff tips. Backs of hands and feet brownish. Tail very long, covered with short dark hairs above and below.

Skull (occipital region broken) large and heavy, with large teeth and broad maxillary region.

Dimensions of the type :—

Head and body 120 mm. ; tail 80 ; hind foot 21·5.

Skull : length of palate 14 ; least interorbital breadth 6·3 ; greatest maxillary breadth 10·5 ; length of upper tooth-row 14·8.

Hab. Chirinda Forest, Melsetter District, S. Rhodesia.

Type. Adult. B.M. no. 8.7.19.20. Original number 26. Collected and presented by C. F. M. Swynnerton, Esq.

In general colour this form most resembles *kivu*, from which it is at once distinguished by its larger teeth.

(19) *Crocidura nyansæ hera*, subsp. n.

Closely allied to the foregoing form, but smaller in size, rather paler on the ventral surface, and with considerably smaller teeth.

Size of body, hind foot, and tail less than in *zuleika*.

General colour of dorsal surface dark chocolate-brown, rather less russet in tint than in the Rhodesian race, between "clove-brown" and "Prout's brown." Ventral surface pale slate-grey washed with pinkish buff, the effect lighter and less brown than in *zuleika*. Backs of hands and feet dirty white. Tail shorter and a trifle paler in colour.

Skull considerably smaller and narrower, more approaching that of *flavescens* in size. Brain-case and maxillary region narrow. Teeth small, especially the second and third upper unicuspid.

Dimensions of the type (measured in the flesh) :—

Head and body 105 mm. ; tail 65 ; hind foot 18 ; ear 11.

Skull : condylo-incisive length 28·8 ; greatest breadth 11·7 ; least interorbital breadth 5·8 ; length of palate 12·5 ; post-palatal length 12·5 ; greatest maxillary breadth 8·8 ; length of upper tooth-row 13·1.

Hab. Shire Highlands, Blantyre District, Southern Nyasaland. Altitude 3000 feet.

Type. Adult female. B.M. no. 10.3.26.4. Original number 4. Collected and presented by R. L. Harger, Esq.

The general colour of this race is very near that of *zuleika* ; the chief distinguishing difference is in size, especially of the skull and teeth, *hera* possessing a much smaller skull, with smaller teeth.

(20) *Crocidura sururæ*, Hell.

Crocidura sururæ, Heller, Smith. Misc. Coll. vol. lvi. no. 15, p. 2 (1910).

Colour very much paler than in *nyansæ*.

General proportions rather less than in the Uganda species.

Colour of dorsal surface pale drab-buff ("hair-brown" or "drab" mixed with "wood-brown"); flanks paler and greyer, the tint gradually fading into the pale greyish silvery-buff of the ventral surface; the entire underparts very much lighter than in *nyansæ*. Backs of hands and feet dirty buff. Tail rather short and hairy, brownish above, paler below; caudal bristles lighter in colour than in *nyansæ*. Lateral glands conspicuously marked by a growth of short white hairs.

Skull of the same general form as that of *nyansæ*, but smaller throughout, with narrower brain-case and smaller teeth.

Dimensions of the type (hind foot measured when dry, and therefore slightly shrunken):—

Head and body 111 mm.; tail 64; hind foot 17.

Skull: condylo-incisive length 28.5; greatest breadth 12; length of upper tooth-row 13.

In the Museum Collection are two specimens collected by Emin Pasha at Wadelai, and a further one from Mongalla collected by A. L. Butler, Esq., which I take to represent this species. In general colour they agree well with Heller's description; the hind feet (18 mm. dried) are slightly larger and the skulls a trifle longer, but I think there can be no doubt that these specimens represent the Lado species.

The following are the skull-dimensions of one of the Wadelai shrews and of the specimen from Mongalla:—

	Wadelai. mm.	Mongalla. mm.
Condylo-incisive length.....	30	33
Greatest breadth.....	12.3	12.3
Least interorbital breadth.....	6	5.7
Postpalatal length.....	13	12.9
Greatest maxillary breadth.....	9.8	9.4
Length of upper tooth-row.....	13.3	13.3

The exact relationship of this species is not very clear; there seems little doubt that it is closely allied to the *nyansæ* group, as is shown by the general form of the skull; but the light grey underparts and bicoloured tail show that it is also closely related to *doriana*. On this account it is here placed between *nyansæ* and *doriana*.

Hab. Rhino Camp, Lado Enclave.

Type. Adult male. U.S. Nat. Mus. no. 164637.

In the Museum Collection there is a very pale-coloured shrew, of the *nyansæ* group, from Unyoro; it seems to be in

some ways intermediate between *nyansæ* and *sururæ*. There is not, however, sufficient evidence to hand to show that *nyansæ* gradually becomes paler as it gets farther north, and, taking into consideration the *doriana*-like characters of *sururæ*, it seems best to regard this latter form as a distinct species.

Group 5 (*doriana* and *flavescens*).

Size large. Colour above dull brownish red, bright rufous brown, or yellowish brown; ventral surface pale grey, distinctly marked off from brown-tinted flanks; tail whitish below. Second and third upper unicuspid about equal in size.

(21) *Crocidura doriana*, Dobs.

Crocidura doriana, Dobson, Ann. Mus. St. Nat. Genova, iv. p. 564 (1887).

Size about as in *nyansæ*, but richer coloured, with much paler and greyer underparts more distinctly marked off from the dorsal surface; tail bicoloured.

General proportions much as in the *nyansæ* group. Colour of dorsal surface rich reddish brown (varies from "auburn" to "pale cinnamon-brown"); flanks scarcely paler, sharply marked off from the greyish-white belly; hairs of belly slate-grey, with long white tips, the general effect much paler than in any of the *nyansæ* group. Backs of hands and feet brownish white. Tail brown above, lighter below, where the hairs, especially in the basal region, are almost white. Spirit-specimens of *doriana* show that the tail is very much thicker, blunter, and more hairy than in *nyansæ*, in this respect agreeing with *flavescens*.

Skull larger than in *flavescens*, averaging slightly smaller than in *nyansæ*. Tooth-row a trifle shorter; teeth similar in shape.

Dimensions (as given by Dobson):—

	♂.	♀.
Head and body	102	95
Tail	73	57
Hind foot	18.5	18

In the Museum Collection is a series from Adis Abeba in which the hind foot is given by the collector as from 17 to 20 mm. in length. A spirit-specimen from the same locality has the following body-measurements:—Head and body 112 mm.; tail 65.5; hind foot 18.5; ear 11.

Skull-dimensions taken from the Adis Abeba specimens :—

	mm.	mm.	mm.	mm.
Condyllo-incisive length	30	28·6	28·4	29
Greatest breadth	12·5	11·6	12	12·2
Length of palate	12·1	12·6	12·3	11·9
Postpalatal length	12·5	11·8	11·9	12·9
Greatest maxillary breadth..	10	9·2	9·1	9·3
Length of upper tooth-row..	13·6	13	12·7	13·3

Hab. Shoa, Abyssinia.

This species is evidently more nearly related to *flavescens* than to the *nyansæ* group, possessing the thick bicoloured tail, distinct definition between the dorsal and ventral surfaces of the body, and cold light grey underparts of the South-African species; only in its general dimensions is *doriana* at all like *nyansæ* and the allied forms. *C. sururæ*, from Lado, would seem to be rather intermediate between *doriana* and the *nyansæ* group.

(22) *Crocidura flavescens*, Is. Geoff.

Sorex flavescens, Is. Geoff. Dict. Class. xi. p. 324 (1827); Mém. Mus. xv. p. 126 (1827).

Sorex cinnamomeus, Licht. Verhandl. Ges. Natur. Fr. Berlin, ii. p. 381 (1829).

Sorex capensis, Smith (nec Smuts, nec Geoff.), S. Afr. Quart. Journ. vol. ii. p. 62 (1833); Ill. Zool. S. Afr. i. pl. xlv. fig. 1 (1849).

Sorex rutilus, Sund. Ofv. Vet.-Akad. Förhandl. p. 119 (1846).

Smaller than *nyansæ*, with much lighter-coloured underparts more distinctly marked off from the brownish tint of the dorsal surface; tail whitish underneath.

Size of body, hind foot, and tail less than in *nyansæ*.

General colour of upper parts, in new pelage, "Prout's brown" mixed with "cinnamon-brown." In the worn state the fur is very much lighter and more brilliant in colour, about as in "Dresden brown." Flanks a trifle paler than back, the brownish tint passing fairly abruptly into the light greyish white of the belly; entire underparts much lighter and colder in colour than in *nyansæ*, "pale smoke-grey" or "pale neutral grey" in the new pelage, "deep olive-buff" in the worn state. Backs of hands and feet dirty white or buff. Tail rather shorter and more hairy, brownish above, white or pale buff below; bristle-hairs whitish, sparingly distributed over proximal two-thirds.

Skull considerably smaller than that of *nyansæ*, with narrower brain-case and muzzle; teeth markedly smaller, second and third upper unicuspid about equal in size.

Dimensions (as given by Geoffroy) :—

Head and body $4\frac{1}{2}''$; tail $1\frac{1}{2}''$.

Dimensions of a series of specimens in the Museum Collection :—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Condyl- incisive length. mm.	Greatest breadth. mm.	Length of upper tooth-row. mm.
♂. Transvaal....	120	59	17	28·6	11·5	12·8
♀. "	110	63	17	28·6	11·3	12·5
♀. "	106	54	15	27	11	12
♀. "	113	54	16	28	11	12·8
♀. "	108	62	15	27·3	10·4	12·5
♂. Cape	108	59	16	..	11·7	12·6
♀. "	113	51	16	27	11·3	12
♀. Pondoland ..	113	56	16·5	26·5	10·9	11·9
♂. Natal	108	60	15	26	10·5	11·5
♀. "	102	52	16	26	10·5	11·5
♂. Zululand	106	57	15	27	11	12
♀. "	106	62	15	26	10·5	11·6
East Griqualand..	110	60	17	27·7	10·9	12·7

A co-type of *rutilus*, preserved in the Museum Collection, shows that the animal is apparently identical with what has here been accepted as *flavescens*, the skull-dimensions being :—Condyl-oincise length 26·8 mm. ; greatest breadth 11 ; length of upper tooth-row 12. The only really large specimen is one from Sir Andrew Smith's collection, which is considerably larger than any of the specimens mentioned above, the tail and hind foot measuring in the dried state 67 and 20 mm. in length respectively ; the tooth-row of this individual is proportionally greater, measuring 13·2 mm. in length. The only locality given is "S. Africa." Until further material comes to hand, I think it best to ignore this large specimen, there being no means of ascertaining where it really came from.

For the present I am placing *cinnamomea* as a synonym of *flavescens* ; there would appear to be very little difference in the descriptions of the two forms except as regards the general dimensions, which are certainly not reliable.

Hab. "... la Cafrerie et le pays des Hottentots."

The smaller size, much lighter-coloured belly, more distinct differentiation between the dorsal and ventral surfaces, and light underside of the tail distinguish this South-African shrew from *nyansæ* and its allies.

[To be continued.]

LI.—*Notes on Bats of the Genus Coleura.*
By OLDFIELD THOMAS.

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A STUDY of the British Museum collection of the genus *Coleura*, amounting to nearly sixty specimens from more than a dozen localities, shows that on the mainland of Africa there are two species: a north-eastern, inhabiting Suakin, Aden, Somaliland, and the Upper Nile; and a southern, which ranges from the Congo to the Zambezi. The former is separable into two colour-races.

Then in the Seychelles there are two forms, both distinguished from those on the mainland by their proportionally longer wings.

The genus may thus be arranged as follows:—

- A. Wings shorter. Forearm not or little more than three times as long as the skull-length*.
 - a. Larger. Forearm 49–52 mm.; skull 16·0 and upwards; maxillary tooth-row 7·2 and upwards. (Ubangui, Angola, Tette.) 1. *C. afra*, Pet.
 - b. Smaller. Forearm 45–48 mm.; skull less than 16; maxillary tooth-row 6·7–7·1. 2. *C. gallarum*, sp. n.
 - a'. Hairs nearly unicolor, wood-brown. (Suakin, Aden, Somali.) 2 a. *C. g. gallarum*.
 - b'. Hairs bicolor, sepia terminally, white basally. (Upper Nile.) 2 b. *C. g. nilosa*, subsp. n.
- B. Wings longer. Forearm more than $3\frac{1}{2}$ times skull-length, 52 mm. and upwards.
 - a. Larger. Forearm 55–57 mm.; skull 15·2; maxillary tooth-row 7·0. (Seychelles, probably Mahé Island.) 3. *C. seychellensis*, Pet.
 - b. Smaller. Forearm 52–54 mm.; skull 14·4–14·7; tooth-row 6·5–6·7. (Silhouette Island, Seychelles.) 4. *C. silhouettae*, sp. n.

It may be noted that the Seychelles species have usually a median septal ridge in the basal pit, and the mainland species not, but there are a great many individual exceptions to this rule. The ridge is always more strongly marked in young specimens than in old ones.

I fail to find any specific value in the characters used by

* From condyle to front of canine.

Peters and Dobson, the relative length of the calcar, or the presence or absence of a groove on the lower lip.

Descriptions of new forms :—

Coleura gallarum, sp. n.

Size decidedly smaller than in *C. afra*, the forearm usually 47–48 mm. in length, the skull markedly smaller in all dimensions. General colour above pale brown—rather darker than “wood-brown,”—the hairs slightly lighter towards their bases, but not conspicuously or abruptly bicolor. Under surface similar in general tone, but the bases of the hairs not lighter than the tips.

Skull as in *C. afra*, except for its smaller size and smaller teeth. Position and development of the small premolar variable.

Dimensions (see table on p. 579).

Hab. Suakin, Somaliland, and Aden. Type from Zeyla, Somaliland. Sea-level.

Type. Old female. B.M. no. 11.8.2.4. Collected 29th October, 1910, and presented by Dr. R. E. Drake-Brockman. Four skins and six skulls from the type-locality.

Other specimens from Suakin (*Anderson, Hotted Smith*), Aden (*Yerbury*), Sheikh, Somaliland (*Drake-Brockman*), Lugh, Somali (*Bottego*).

Coleura gallarum nilosa, subsp. n.

Essential characters of the Somali *C. gallarum*, but the colour, instead of being more or less uniformly pale brown, is a darker brown—sepia—on the surface, the bases of the hairs being strongly contrasted white; the long hairs of the nape are white for about 3.5 mm., the terminal 2 mm. being sepia. Below, the general colour is rather greyer, but the bases of the hairs are similarly contrasted whitish, the contrast showing well in the long hairs of the flanks, which are almost uniformly coloured in true *gallarum*.

Dimensions (see table on p. 579).

Hab. Upper Nile. Type-series from near the mouth of the Bahr-el-Zeraf.

Type. Adult male. B.M. no. 15.3.6.76. Original number 77. Collected 3rd February, 1914, by Willoughby P. Lowe. Twelve specimens.

Coleura silhouette, sp. n.

Like *C. seychellensis*, but smaller.

General proportions as in *C. seychellensis*, the wings similarly longer than in the mainland species, the forearm about $3\frac{3}{4}$ times as long as the skull measured from the condyle to the front of the canines. Fur rather shorter than in *C. gallarum* and extending less upon the membranes; hairs of back about 3, of nape 4.5 mm. in length. Colour dark brown, rather darker than "bistre," the bases of the hairs scarcely lighter; under surface similar in general tone, but the tips of the hairs are slightly lighter than the bases.

Skull like that of *C. seychellensis*, but smaller throughout. A mesial septal ridge generally present in the basial pit.

Dimensions (see table on p. 579).

Hab. Silhouette Island, Seychelles.

Type. Adult male (skinned from spirit). B.M. no. 6.3.18.2. Collected and presented by Prof. J. Stanley Gardiner. Six specimens.

The Museum contains two authentic specimens, one of them a co-type, of Peters's *C. seychellensis*, besides a third from "Zanzibar." These differ so uniformly from the six examples obtained by Prof. Gardiner on Silhouette Island that it is evident that the Seychelles contain different forms of the genus, no doubt inhabiting different islands. While it is not definitely recorded on which island Dr. Percival Wright obtained the typical examples of *C. seychellensis*, for he mentions in connection with the species Mahé, Praslin, and Silhouette, it is presumably from the first of these islands that he got the specimens, as he says* that "it was very common in the neighbourhood of the town of Port Victoria, Mahé," and it was there that he stayed for most of his time in the Seychelles, merely making casual visits to Praslin and Silhouette.

The example from "Zanzibar" referred to *C. seychellensis* by Dobson appears to me to be rightly so named, but I should think it possible that its asserted locality is erroneous. It was presented by a captain in the Navy, whose station would have included the Seychelles, where the bat may have either been caught or come on board, to be afterwards captured at Zanzibar.

As illustrating the greater length of the wing in the Seychelles species, it will be seen from the table of dimensions that *C. silhouette* has a smaller skull than *C. gallarum*, but yet has an absolutely longer forearm.

* Ann. & Mag. Nat. Hist. (4) ii. p. 437 (1868).

Table of Dimensions.

	Locality.	Sex.	No.	Forearm.	Skull-length (condyle to front of canine).	Maxillary tooth-row.	Front of p^4 to back of m^3 .
<i>Coleura gallarum gallarum</i> ...	Aden.	♂	95. 6. 1. 18	mm. 48	mm. 15.5	mm. 7.3	mm. 5.3
" "	"	♀	95. 6. 1. 22	47	15.4	7.2	5.1
" "	Suakin.	♂	3. 12. 8. 18	48	14.9	6.7	5.0
" "	Zeyla, Somaliland.	♂	11. 8. 2. 1	45	15.1	6.9	5.1
" "	"	♀	11. 8. 2. 4 *	47.5	15.7	7.1	5.2
" "	Bahr el Zeraf.	♂	15. 3. 6. 76 *	48	15.2	6.8	5.0
" "	Tette.	♂	7. 1. 1. 703 *	50	16.0	7.5	5.5
" "	"	♀	58. 6. 18. 12 *	50	16.1	7.6	5.6
" "	Angola.	♂	7. 5. 31. 1	52	16.5	7.4	5.4
" "	Ubangui.	♀	7. 7. 8. 40	52	16.2	7.2	5.1
" "	(Mahe) Seychelles.	♂	69. 2. 19. 2 *	56	15.2	7.0	5.0
" "	"	♀	83. 8. 6. 1	57	15.3	7.0	5.0
" "	" Zanzibar."	♂	76. 10. 10. 1	56.5	15.1	6.8	5.0
" "	Silhouette.	♂	6. 3. 18. 2 *	53	14.4	6.5	4.7
" "	"	♂	6. 3. 18. 3	52.5	14.7	6.7	4.7

* Types or co-types.

LII.—*Note on British Fossil Species of Apodemus.*

By MARTIN A. C. HINTON.

THE fossil remains of wood-mice before me were obtained from deposits of four distinct ages. It now appears that all are members of the *Apodemus sylvaticus* group. Of *A. agrarius* or *Micromys* no trace has been discovered.

1. CROMERIAN (Forest Bed).

Apodemus sp.

Mus sylvaticus, Newton, Vert. Forest Bed, p. 93, pl. xiv. fig. 11 (1882).

Horizon. Upper Freshwater Bed of West Runton, Norfolk.

Mr. Newton figured a fragmentary right ramus from this deposit. Mr. Savin has kindly lent me the material collected by him since 1882, namely, ten more or less imperfect mandibular rami and a fragment of a left maxilla with $\underline{m.1}$ in place; these specimens came from the lower sandy part of the deposit. Mr. White has lent me a left $\underline{m.1}$ and a left $\underline{m.1}$ from the middle or "peaty" portion, while I found myself a right $\underline{m.1}$, with a little of the maxilla adhering to it, in the upper bed or "Monkey gravel."

The three lower cheek-teeth are present in one of Mr. Savin's specimens, and they measure together 3.6 mm. In pattern all the teeth found are indistinguishable from those of *A. sylvaticus*. The material is, however, quite insufficient for fine determination, and merely proves that the Cromerian species was a member of the *sylvaticus* group. It may, later on, prove to be identical with the form next described.

2. EARLY PLEISTOCENE.

Apodemus whitei, sp. n.

"*Mus* sp. allied to *M. sylvaticus*," Hinton, Proc. Geol. Assoc. xxi. p. 492 (1910).

Horizon. The High Terrace Drift of the Thames at Ingress Vale, near Greenhithe, Kent.

Characters. Size and dentition essentially as in *A. sylvaticus*. Maxillo-palatine suture extending forwards to level of antero-internal cusp of $\underline{m.1}$; incisive foramina terminating behind slightly, but distinctly, in advance of the anterior root of $\underline{m.1}$.

The only available material from this deposit is that in the

collection of Mr. G. White. It comprises the greater part of a left maxilla with $\frac{m.1}{m.1}$ in place, a number of detached teeth, including examples of $\frac{m.1}{m.1}$, $\frac{m.2}{m.1}$, and the upper and lower incisor.

The teeth are quite similar in form and size to those of *A. sylvaticus*; in $\frac{m.2}{m.1}$ cusps 1 and x' (see Barrett-Hamilton and Hinton, 'British Mammals,' ii. pl. xxviii.) are normally developed.

In the maxillary fragment the lower portion of the root of the zygoma is present, and the palatal surface, from the hinder margin of the incisive foramen to the maxillo-palatine suture, is complete. The latter suture is deeply digitated, and extends as far forwards as the antero-internal cusp (x') of $\frac{m.1}{m.1}$, instead of being situated opposite the hinder part of this tooth or the front part of $\frac{m.2}{m.1}$, as in recent *sylvaticus*. The posterior margin of the incisive foramen is placed slightly, but distinctly, in front of instead of level with the anterior root of $\frac{m.1}{m.1}$. These two small characters distinguish the fossil from all the many skulls of *sylvaticus* which I have examined, and they serve to show that one cannot assert the fossil to be identical with any living member of the group. It is, therefore, proposed to regard the High Terrace form as a distinct species, for which the name *A. whitei* is used. Having regard to the faunistic agreement which subsists between the High Terrace Drift and the Forest Bed, it is by no means improbable that the fossils from the latter horizon will prove later on to be referable to *A. whitei* also.

3. MIDDLE PLEISTOCENE.

Apodemus sp.

Mus sylvaticus, Hinton & Kennard, Essex Naturalist, vol. xi. p. 347 (1900).

Horizon. The Middle Terrace Drift of the Thames at Grays Thurrock, Essex.

From this deposit numerous detached teeth and a fragment of a right ramus were obtained by Mr. J. P. Johnson and Mr. G. White. These remains agree in size and dental pattern with *A. sylvaticus*, but they do not permit of precise determination.

4. LATE PLEISTOCENE.

(a) *Apodemus sylvaticus*, L.

A large number of remains, indistinguishable in size or

character from those of this species, have been obtained from the fissure-deposit of Ightham, Kent, many British and Irish cavern-deposits of Late Pleistocene age, as well as from several "submerged forests" and other Holocene accumulations. No tolerably complete skull has, so far as I am aware, been found hitherto, and, in the absence of such material, no close comparison with any of the numerous forms of this plastic species can be made.

(b) *Apodemus lewisi*, Newton.

Mus abbotti, Newton, Quart. Journ. Geol. Soc. vol. l. p. 195, pl. xi. fig. 8 (1894); not *M. abbotti* of Waterhouse.

Mus lewisi, Newton, P. Z. S. 1899, p. 381.

Based on lower jaws and parts of skulls from the Late Pleistocene fissure-deposit of Ightham, Kent.

This is a large form which is closely related to, if it be not identical with, *A. flavicollis*, Melchior. Mr. Newton states that the anterior "accessory" cusp of \overline{m}_1 is very small or wholly lacking. To this feature no great significance can be given, because the cusp in question is frequently very small, or, in slightly worn teeth, apparently absent in the recent *A. flavicollis*, as also in some races of *A. sylvaticus*. The fossil material is very imperfect, and when fairly complete skulls come to hand they may show differences from either of the two western subspecies of *flavicollis*; in the meantime, it is better to maintain *A. lewisi* as a separate species than to assert that it is identical with *flavicollis*.

I have recently referred to *A. lewisi* specimens from three other British Late Pleistocene deposits, viz.:—

Kent's Cavern, Torquay.—A right ramus (length 16·5 mm., tooth-row 4·3 mm.) in the collection of Mr. Herron. This was obtained from an upper stratum which yielded typical Late Pleistocene rodents (*Ochotona*, *Microtus anglicus*, *ratticeps*, and *Arvicola abbotti*).

Happaway Cave, Torquay.—Anterior part of a skull and a left ramus (cheek-teeth 4·2 mm.); B.M. no. M. 5806 (Pengelly collection).

Wye Cave, Gloucestershire.—Anterior part of a skull; B.M. no. 7789 (collected by Miss D. M. A. Bate).

In both the Happaway and the Wye cave-skulls the teeth are much worn; the interorbital margins are sharp, the superciliary ridges, particularly in the Wye specimen, being sharply defined. The following dimensions show how

closely these fossils agree with the skulls of equally aged individuals of the living British *A. f. wintoni* :—

	Happaway Cave.	Wye Cave.	<i>A. f. wintoni</i> (3 specimens).		
Interorbital constriction....	4.4	4	4.3	4.5	4.4
Nasal width.....	3.5 ca.	3.3	3.3	3.1	3
Palatal length.....	14.2	14.4	13.7	14	13.9
Diastema	7.5	7.6	7.4	7.3	7.3
Incisive foramina, length ..	5.7	5.5	5.3	5.5	5
" " width ..	1.8	2.1	1.9	1.8	1.8
Rostral breadth	5.4	5.3	5.5	5.3	5.4
Masseteric plate-width	2.9	2.5	2.8	2.6	2.7
Cheek-teeth.....	3.8	3.9	4	4	3.7

From the available evidence, it would appear that a *flavicollis*-like form first appeared in Britain in Late Pleistocene times, while the *sylvaticus* group proper had representatives here as far back as the Late Pliocene or Cromerian stage. This would at first sight tend to support Miller's opinion (which I share) that *flavicollis* is really a distinct species from *sylvaticus*; but this support may be negated by the following considerations.

Like *Evotomys*, the *Microtus agrestis* group, and the early species of *Arvicola*, *Apodemus* was present in this country in the earlier part of the Middle Terrace stage; and the forms found in the Grays brick-earth are more or less clearly the descendants of Cromerian ancestors. Some of these old forms appear to have lingered on to the time represented by the Ilford brick-earth. Now, although many small rodent bones and teeth have been collected from the later Middle Terrace deposits of the Thames at Crayford and Erith, no trace of either *Apodemus* or the other rodents named has been found there; the place of these forms appears at that time either to have been unoccupied or else to have been taken by quite new forms. Subsequently, in the Late Pleistocene (Ightham stage), *Evotomys*, the *Microtus agrestis* and *arvalis* groups, *Arvicola*, and the *Apodemus sylvaticus* group (now including a form like *flavicollis*) make a reappearance by forms much more clearly and closely allied to the living species of Western Europe than are those of the older deposits. Such facts caution us against referring the fragmentary fossils from the Forest Bed and earlier Pleistocene to living species.

I would take this opportunity of correcting a silly error in

my paper on British *Apodemus* (Ann. & Mag. Nat. Hist., July 1914). The whole of the last paragraph on p. 130 should be deleted. The young specimen referred to is a house-mouse, the skin figured by accident as that of a young *Apodemus* in the first list (P. Z. S. 1913, p. 836). Later on, through misreading a label, I associated the skin with the skull of a young *Apodemus*.

LIII.—*The Holotype of Nymphon gracilipes, Miers (Pycnogonida).* By W. T. CALMAN, D.Sc.

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ALTHOUGH several writers have discussed *Nymphon gracilipes*, Miers, since its first description in 1875, no one appears to have re-examined the holotype, and a good deal of unnecessary confusion has therefore gathered round the species. As a result of comparison of the holotype with other specimens in the British Museum collection, the following synonymy is proposed:—

Nymphon gracilipes, Miers.

Nymphon gracilipes, Miers, Ann. & Mag. Nat. Hist. (4) xvi. p. 76 (1875, not later than 1st July); ?? Böhm, MB. Akad. Wiss. Berlin, 1879, p. 170, pl. i. figs. 1-1e; nec *N. gracilipes*, Heller, Denkschr. math.-nat. K. Akad. Wiss. Wien, xxxv. p. 40, pl. iv. fig. 15, pl. v. figs. 1 & 2 (1875, later than 19th July).

Nymphon antarcticum, Miers, Phil. Trans. Roy. Soc. clxviii. p. 211, pl. xi. fig. 7 (1879); nec *N. antarcticum*, Pfeffer, Jahrb. Hamburg. Wiss. Anst. vi. 2te Hälfte, p. 42 (1889).

Nymphon meridionale, Hoek, Rep. Pycnogonida 'Challenger,' p. 43, pl. iii. figs. 4-8 (1881).

Nymphon fuscum, Hoek, t. c. p. 48, pl. iv. figs. 8-11.

Description of holotype.—The specimen is a female, with genital apertures distinct and ova visible within the femora.

Trunk elongated and slender, lateral processes separated by much more than their own diameter. Cephalic segment as long as remaining somites together; neck about two-fifths as wide as anterior dilatation of cephalon. Ocular tubercle not higher than wide, rounded or very obtusely pointed, inclined backward; eyes large.

Proboscis cylindrical, straight, about two-and-a-half times as long as wide.

Abdomen elevated, bluntly pointed.

Chelophores with scape less than five times as long as wide. Chela as long as scape, palm widening distally, more than twice as long as its greatest width. Fingers longer than palm, with large and rather widely-spaced teeth, movable finger strongly arched. Setose cushion at base of immovable finger extending one-third of its length.

Palps slender, third segment three-fourths as long as second, fourth shorter than third or fifth.

Ovigers with fourth segment nearly two-thirds as long as fifth.

Legs slender, with few setæ except on tarsus and propodus. Second coxa hardly longer than the other two together. Femur a little shorter than first tibia and more than two-thirds as long as second. Tarsus longer by one-fourth than the propodus. Claw less than one-third of length of propodus, auxiliaries more than half as long as main claw.

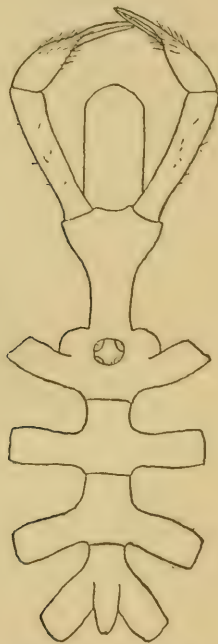
Measurements in millimetres :—

	<i>N. gracilipes</i> , Holotype ♀.	<i>N. fuscum</i> , Syntype ♂.	<i>N. meridionale</i> , Holotype ♂.
Length of proboscis	2.08	1.44	1.68
Diameter of proboscis .....	.84	.6	.6
Length of cephalic segment	2.56	1.88	2.2
Width of cephalon anteriorly	1.42	.96	1.08
Width of neck .....	.52	.36	.36
Length of trunk	5.28	3.72	4.4
Width between first and second lateral processes .....	.56	.44	.4
Width across second lateral process ..	2.8	2.32	2.4
Leg :—			
First coxa .....	.8	.6	.6
Second coxa	2.2	1.76	1.4
Third coxa	1.2	.72	.84
Femur	7.2	4.0	4.2
First tibia	8.0	4.72	5.0
Second tibia	10.4	7.2	7.32
Tarsus	1.92	1.66	1.52
Propodus	1.6	1.52	1.32
Claw .....	.48	.4	.52
Auxiliaries .....	.28	.22	.25
Palp :—			
Second segment	1.2	.85	.95
Third segment .....	.9	.6	.72
Fourth segment .....	.7	.48	.52
Fifth segment .....	.8	.45	.52

Holotype.—Female in British Museum, collected at Royal Sound, Kerguelen, by Rev. A. E. Eaton. Reg. no. 76. 27.

Remarks.—Miers's first description of this species was published "certainly not later than 1st July, 1875" (as I am informed by Messrs. Taylor and Francis), and therefore preceded Heller's application of the same name to an arctic species in a paper communicated to the Vienna Academy on 19th July, 1875. Miers's alteration of the name to *N. antarcticum* was unnecessary, but renders invalid Pfeffer's use of

Fig. 1.



Nymphon gracilipes, Miers, holotype, dorsal view. Legs and palps omitted. $\times 10$.

N. antarcticum for a species from South Georgia, which now requires a new name. Heller's species, renamed *N. helleri* by Böhm *, is identified by Hoek and others with *N. strømmii*, Krøyer, and by Norman † with *N. giganteum*, Goodsir.

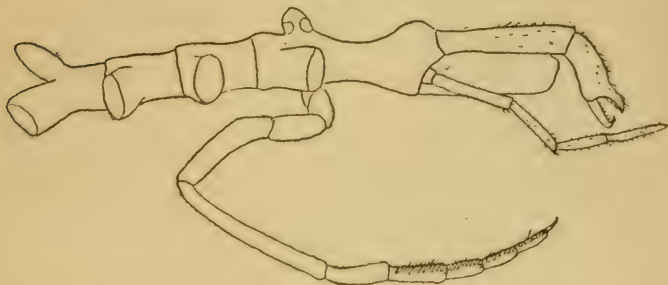
Miers's descriptions and figures are quite inadequate, and

* MB. Akad. Wiss. Berlin, 1879, p. 170.

† Journ. Linn. Soc., Zool. xxx. p. 214 (1908).

subsequent writers, such as Hoek and Bouvier, have relied upon Böhm's account for the characters of the species. Böhm, however, figures the ocular tubercle as of very unusual form, more than twice as tall as wide, and with a marked "shoulder" below the conical apex. He further

Fig. 2.



Nymphon gracilipes, Miers, holotype, from right side. Legs omitted.
× 10.

Fig. 3.



Nymphon gracilipes, Miers, holotype. Chela. × 25.

Fig. 4.



Nymphon gracilipes, Miers, holotype. Terminal segments of one of the legs. × 25.

shows the second segment of the palp as more than twice as long as the third. Unless these figures are altogether untrustworthy, he must have been dealing with a different species.

Hoek described, from the 'Challenger' Expedition, two species, *N. fuscum*, from 25 fathoms off Royal Sound, Kerguelen, and *N. meridionale*, from 1675 fathoms in the Antarctic Ocean, which he compared with Miers's (or, rather, Böhm's) species, in each case mentioning as one of the chief differences the form of the ocular tubercle. Hodgson* has recently commented on the difficulty of distinguishing these species from each other and from *N. antarcticum* (*N. gracilipes*). I have compared the types of all three species, and I am no more able than Mr. Hodgson to indicate satisfactory distinctions between them. The only difference that seems at all likely to be of importance is in the form of the chela, which, in *N. gracilipes*, is a good deal elongated, the palm being more than twice as long as wide. In the other two forms the palm is less than twice as long as wide and the fingers correspondingly shorter. The other differences in proportion shown by the measurements given above (including the relative lengths of tarsus and propodus mentioned by Hodgson) seem to be insignificant.

LIV.—*Brief Descriptions of new Thysanoptera*.—VI.
By RICHARD S. BAGNALL, F.L.S.

Suborder TEREBRANTIA.

Family Thripidæ.

Genus HOMOTHRIPS, nov.

Head transverse, cheeks diverging posteriorly. Antennæ of usual Thripid type, but having a 3-jointed style which is not quite so long as the sixth joint. Mouth-cone constricted near middle, reaching across prosternum; maxillary palpi long, 3-jointed, the middle joint the shortest. A pair of very long fine inter-ocular bristles, and four immediately behind antennæ between eyes. Prothorax transverse, with two long bristles at each hind angle. Fore-legs simple. Wings well-developed; fore-wings with both veins regularly set with setæ. Abdomen elongate; last two segments normal, and bristles on them long.

Type. *Homothrips distinctus*, mihi.

This genus differs from all genera excepting *Rhampothrips*,

* Ann. & Mag. Nat. Hist. (8) xv. p. 142 (1915).

Karny, in the 3-jointed antennal style. From the latter it may at once be separated by the simple fore-tibiæ and tarsi and the regularly set upper-vein of fore-wing.

Homothrips distinctus, sp. n.

♀.—Length 1.4 mm.

General colour yellow; legs, basal antennal joints, and abdomen lighter, almost white; tip of abdomen and disc (at least) of tergites 2–8 slightly tinged with brown; mesothorax near juncture with prothorax, the disc of pronotum and the head (excepting a patch at hind corners, from the eye broadening posteriorly) brown. Antennæ approximate, joints 3–5 weakly claviform, 6 constricted at base and broadly united to style; relative length of joints 3 to 9 approximately 15 : 14 : 11 : 13 : 3 : 3 : 5. Forked trichomes on 3 and 4. Eyes very largely faceted, and minutely and sparsely pilose. Ocelli set well back.

Prothorax about as long as head and about 1.6 times as broad as long, surface sparsely setose. Bristles at posterior angles about 0.75 the length of the prothorax. Pterothorax longer than broad and broader than the prothorax. Legs usual, rather stout; hind-tibiæ with a double row of setæ inside for the distal two-thirds of its length. Wings reaching to abdominal segment 8; setæ of fore-wing long; costa, upper vein, and lower vein furnished with 25, 22 (5 and 17), and 15 respectively; lower cilia long. Abdomen long and linear; segment 9 sharply narrowed to base of 10, and bristles on these segments strong and considerably longer than the segment bearing them; 9 furnished with a latero-dorsal pair in addition to the series at apex.

Hab. SOUTH AFRICA, from flowers of “sugar-bush” (Proteaciæ), gathered at Cape Town, July 13th, 1914 (*Professor E. B. Poulton*).

A. PHYSOTHRIPS group.

Genus MEGALUROTHRIPS, nov.

Allied to *Physothrips*. Head with a long and strong pair of inter-ocellar bristles, maxillary palps Bristles on prothorax Mesonotum with a long bristle somewhat remote from each shoulder. Both veins of fore-wing regularly set with setæ. Abdominal segments 9 and 10 abnormally large, together longer than the length of head and prothorax, sharply obconical.

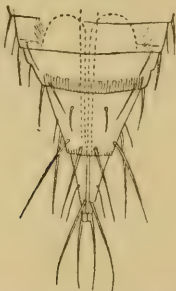
Type. *Megalurothrips typicus*, mihi.

Megalurothrips typicus, sp. n.

♀.—Length about 1·4 mm.

General colour dark brown ; fore-tibiæ yellowish distally, and all tarsi yellowish. Antennal joints 3 and 4 yellow, the latter shaded brown distally, and 5–8 light brown, with 5 yellowish at base. Fore-wings light yellowish-brown, with a light patch near base and another near tip. Head transverse, 1·4 times as wide as long ; eyes coarsely faceted, pilose. A series of minute dorsal setæ on a line behind eyes.

Fig. 1.



Megalurothrips typicus, gen. et sp. n. End of abdomen, ♀. Dotted line showing ovipositor and sheath.

Ocelli rather large, the hind pair well separated and the posterior one forwardly directed and protected by a pair of very long inter-ocular bristles which are as long as the two basal antennal joints together. Antennæ about 2·6 times the length of the head, joint 3 *apparently* shorter than 4 ; 5 distinctly shorter than 3, 4, or 6 ; the style about 0·5 the length of 6, with the apical joint longer than 7. Trichomes and bristles long.

Prothorax 1·4 times as long as the head. It is impossible to say from the imperfect specimen if there is one or two long bristles at each hind angle. Legs rather stout. Pterothorax about as long as broad, large. Wings reaching to the ninth abdominal segment ; costa, upper and lower veins of fore-wings furnished with approximately 22, 17 (3+14), and 15 longish setæ respectively. Abdomen (excluding segments 9 and 10) elongate-ovate, 9 and 10 subequal in length and distinctly longer than any of the preceding segments and sharply obconical ; 10 open above.

A pair of straight lateral bristles on 8 reaching beyond the middle of 9, and 9 and 10 furnished with long bristles, longer than the segments bearing them, and those on 9 over-reaching the tip of 10.

Hab. W. SARAWAK, Mt. Matang; 1 ♀ caught on the wing, December 1913 (*G. E. Bryant*).

Teniothrips seticollis, sp. n.

♀.—Length 1.3 mm.

Dark grey-brown, thorax yellowish in part, head darker than the prothorax. Antennæ with joint 1 yellowish-brown, 2 lighter, 3 yellow, 4 to 8 greyish-brown, with 4 lighter basally. All femora yellowish to grey-brown; tibiæ yellow, lightly shaded to grey or grey-brown; tarsi yellowish. Fore-wings light greyish-brown, basal fourth white.

Head nearly as long as broad, cheeks swollen and eyes prominent; surface transversely striate. Eyes coarsely faceted, pilose. Ocelli on a prominence, large, posterior pair placed close to inner margin of eyes and well back, anterior one forwardly directed.

Antennæ at least twice as long as head; joints 3 and 4 fusiform, practically subequal; 5 about 0.85 the length of 4, and 6 practically as long as 4, the two-jointed style very short, only 0.3 the length of joint 6. Forked trichomes on 3 and 4.

Prothorax slightly longer than the head and about 0.8 as long as broad; the two long bristles at each hind angle slender and more than 0.5 the length of prothorax. Surface and side sparingly set with somewhat longish setæ, mostly curved and directed backwards. Fore-legs stouter than the others and (with hind and intermediate legs) also set with rather long curved setæ; the hind-tibiæ furnished for the length of the inner margin with a double row of straight setæ, terminating distally with a pair of stout yellow spines. Pterothorax more than twice as long as the pronotum and as broad across mesonotum as long. Wings long, reaching to the eighth abdominal segment. Fore-wings pointed distally; upper vein furnished with 19 and lower vein with 17 moderately long setæ. Setæ on costa 27, increasing in length towards apex of wing; upper fringe sparse, delicate; lower fringe wavy. Abdomen elongate-ovate, broader than the pterothorax and approximately 2.5 times as long as broad; segments 8 and 9 sharply narrowed to base of 10; 10 open above. Abdominal bristles light brown, those on 9 and 10 longer than the segments bearing them.

Hab. W. AUSTRALIA; 1 ♀ taken by Professor E. B. Poulton, F.R.S., with examples of *Isoneurothrips australis*, sp. n., from the flowers of a small tree of *Acacia* sp. (probably *A. baileyana*, F. v. Müll.), Mundaring Weir, Darling Range, Perth, August 3rd, 1914 (tube 16).

Differs from known species by the fore-vein of fore-wing, which is regularly set with setæ—a character generally regarded as of generic importance.

B. THRIPS group.

Genus *ISONEUROTHRIPS*, nov.

With all the characters of *Thrips* (+ *Bagnallia*), but having the whole of the upper-vein of fore-wing regularly set with setæ as well as the lower.

Type. *Isoneurothrips australis*, mihi.

a. *Thrips* s. str. type.

Isoneurothrips australis, sp. n.

♀.—Length 1·4 mm.

General colour yellow, with dark setæ. Head only lightly tinged with grey, vertex brownish; pronotum yellowish-brown; pterothorax tawny, tinged with brown at margin. Abdomen yellow, segments 9-10 wholly dark grey-brown, other tergites light grey-brown and pleurites yellowish. Legs yellow, tinged with grey. Fore-wings greyish-yellow with setæ and cilia dark. Eyes black and ocelli with crimson hypodermal crescentic margins. Head transverse, about 0·7 as long as broad; cheeks arcuate. Eyes prominent, coarsely faceted, pilose. Some short, erect, genal setæ behind eyes and a dorsal series approximately on a line behind eyes.

Antennæ about three times as long as the head; first joint yellow, second grey-brown, third yellowish, irregularly tinged with grey-brown; fourth and fifth rich purple-grey, yellow basally, and 6 of the same rich colour in the basal two-thirds, but with the apical third together with the style light grey. Joints 3 and 4 fusiform, and together with 6 approximately subequal; 5 much smaller and style very short.

Prothorax longer than head, bordered anteriorly; the two prothoracic bristles at each hind angle about one-third the length of the pronotum, stout and almost black; a series of shorter postero-marginal setæ. Surface sparsely and minutely

setose. Legs almost as in the previously described species, but with more minute setæ, and the series of setæ on inner side of hind tibiæ shorter and stouter and starting at about the middle. Pterothorax large, at least 1·6 times as broad as the prothorax and but slightly longer than broad; disc faintly reticulated. Wings reaching to eighth abdominal segment; setæ of fore-wing short, stout, and very dark. Costa, upper and lower vein furnished with approximately 38, 28 (3+7+18), and 23 setæ respectively, upper fringes sparse, lower wavy. Abdomen elongate, narrower than the pterothorax, with sides subparallel to segment 6, thence faintly narrowing to 8; 9 and 10 together obconical, and the latter open dorsally; bristles on 9 and 10 long.

A fine, richly coloured species.

Hab. W. AUSTRALIA; taken by Professor E. B. Poulton from the flowers of a small *Acacia*-tree (probably *A. baileyana*, F. v. Müll.). Mundaring Weir, Darling Range, Perth, Aug. 3rd, 1914 (tube 16), and from the flowers of *Acacia pulchella*, R. Br., Cottesloe Beach, near Fremantle, Aug. 31st, 1914 (tube 26).

b. *Bagnallia* type.

Isoneurothrips orientalis, sp. n.

♀.—Length approximately 1·4 mm.

Colour dark blackish-brown; fore-femora lighter brown, with tibiæ yellowish, shaded to brown at margins; intermediate tibiæ somewhat lighter distally. Antennal joint 3 yellowish-white, tinged with grey to a light brown, 4 greyish-white at base and 5 to 7 entirely brown. Head about 0·85 as long as broad, surface transversely striate; eyes moderately largely faceted, pilose. Ocelli large, placed well back, and posterior pair touching the inner margin of eyes. Antennæ 2·2 times as long as the head, joints 4 to 7 slender, 3 and 4 constricted near apex; approximate length and breadth of 3 to 7 as follows:—

$$\frac{18 : 19 : 14 : 18 : 5}{6 : 7 : 5 : 5 : 2}$$

Prothorax quadrate, scarcely longer than the head; 1·5 times as broad as long. Setæ at hind angles long, 0·5 as long as the pronotum. Legs much as in *I. australis*. Wings grey-brown, setæ longer and more slender than in *I. australis*. Abdomen long and linear.

♂.—Smaller. Sternites 3 to 7 each with a strongly transverse area much as in *Baliothrips dispar*, the first two being the largest.

Hab. W. SARAWAK, Mt. Matang, at 1000 feet, December 20th, 1913; 2 ♀s and 1 ♂ in a white flower (*G. E. Bryant*).

Unfortunately imperfect.

Suborder TUBULIFERA.

Family Phlæothripidæ.

A. MACROTHRIPS group.

Adiaphorothrips antennatus, sp. n.

Length about 5.0 mm.

Very like *A. simplex*, Bagn.; head shorter and less than 1.5 times as long as broad, genal setæ and the inter-ocellar bristles distinctly longer and stronger than in *simplex*. Antennal joints 3 to 5 practically subequal, 3 being apparently shorter than 4 (approximately 21:23:22, instead of 29:26:21 in *simplex*). Male smaller, with the head comparatively longer, and the tube only about 1.15 times the length of the head as compared with 1.3 times the length in the female. A distinct wart at extreme apex of each foretibia within.

Hab. W. SARAWAK; 1 ♀, Mt. Matang, at 1000 feet, from under bark of dead tree, Dec. 7, 1913, and 1 ♂, Quop, March 28th, 1914 (*G. E. Bryant*). Mr. Bryant also collected examples of *A. simplex* from both localities.

B. TRICHTHRIPI group.

Genus TETRACANTHOTHRIPI, nov.

Comes in *Trichothrips* group. Size small. Head broader than long, cheeks arcuate, narrowed to base, and armed with short strong spines. Mouth-cone Antennæ

Prothoracic setæ very long. Fore-coxæ with one long strong seta and a few shorter ones. Anterior margin of mesonotum armed on each side with two stout finger-like spines and other smaller ones. Tube normal in shape, but with distinct though somewhat weak longitudinal carinations basally.

The spine-like mesonotal processes are a peculiar feature.

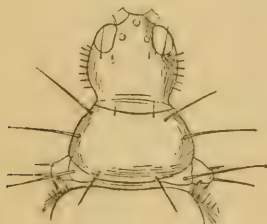
Type. *Tetracanthothrips borneensis*, m.

Tetracanthothrips borneensis, sp. n.

♂.—Length about 1·6 mm.

Dark brownish-black, shining; pterothorax medianly in form of an inverted triangle light yellowish-brown; head not so dark as prothorax; the two basal antennal joints (rest broken off in the unique specimen) yellow. Fore-legs yellow to yellowish-brown, with the femora shaded to brown basally; hind and intermediate legs darker, but yellowish above knees. Tube brownish at apex. Fore-legs incrassate; intermediate and hind-femora with some strong spines on the upper margin near or beyond middle. Bristle at each hind angle of prothorax longer than the length of the prothorax through middle. Wings short, vestigial. Abdomen broadly ovate; segments strongly transverse. Tube not quite so

Fig. 2.



Tetracanthothrips borneensis, gen. et sp. n. Head, pronotum, fore-coxæ and front of mesonotum.

long as the head. Abdominal hairs long; those on segment 9 as long as tube, and on 6 and 7 longer; mostly dark, but some on 8 and 9 practically colourless.

Hab. W. SARAWAK; 1 brachypterous ♂, Mt. Matang, December 1913 (*G. E. Bryant*).

Allothrips caudatus, sp. n.

♂.—Forma *macroptera*.

Length about 2·3 mm.; breadth of pterothorax 0·45 mm.

Yellowish- to greyish-brown; head and pterothorax yellowish medianly. Abdomen dark grey to black-brown; tube reddish, shaded with brown at apex. Fore-legs yellowish, shaded to grey-brown; outer margin of femora darkest; hind and intermediate femora dark grey-brown; all tarsi yellow. Antennal joint 3 yellow, tinged with grey distally; 4 and 5 yellowish, shaded with grey-brown basally and distally; 6 yellowish basally. Head large, as broad as long and nearly

twice the length of the prothorax; cheeks very slightly converging posteriorly. Eyes occupying dorsally about one-third the length of head, finely faceted; postocular bristles long, pointed. Ocelli large, placed well forward, the posterior one situated at the apex of raised vertex and forwardly directed. Mouth-cone short, broadly rounded, and reaching about 0.65 way across the prosternum; labial palps rather long. Antennæ about twice the length of the head, seven-jointed, joints 3 to 5 claviform and 3 and 4 practically subequal. Relative lengths and breadths of joints 3 to 5:—

30 : 32 : 28 : 24 : 28

13 : 14 : 12 : 11 : 10

Joint 6 constricted apically and truncate distally, and 7 elongate, oviform. Sense-cones long and slender.

Prothorax strongly transverse, more than 2.5 times as broad as long; all prothoracic setæ present, long and pointed, the postero-marginal pairs about 0.6 the length of prothorax. Fore-legs incrassate, tarsal tooth stout; single prominent seta on each coxa. Pterothorax scarcely broader than the breadth across fore-coxæ, about 0.875 as long as broad. Wings reaching to abdominal segment 8; cilia smoky brown. Abdomen slightly broader than pterothorax, elongate, with segments strongly transverse; segments 7 to 9 roundly narrowed to base of tube. Tube a little longer than the head, twice as broad at base as at apex; more sharply (and somewhat roundly narrowed) from about middle. Terminal hairs only about 0.4 the length of tube. Abdominal bristles yellowish, pointed, some on 7 to 9 long, the longest on 9 being about 0.8 the length of the tube.

Sharply separated from the only other described species, *A. megacephalus*, Hood, by its coloration, larger size, the longer antennal joints 3 to 7, the shorter pronotum and mouth-cone, the long tube, and nature of chaetotaxy.

Hab. W. SARAWAK; 1 ♂, Mt. Matang, Dec. 11th, 1913 (*G. E. Bryant*).

Family *Ecacanthothripidæ*.

There are evidently several species of *Ecacanthothrips*, and all available material requires re-examination. *E. bryanti*, Bagn., *E. crassiceps*, Karny, *E. sanguineus* (Bagn.), and *E. steinskyi* (Schmutz), have already been described; but in Mr. Bryant's very interesting Bornean material is a series of *Ecacanthothrips* characterized by the simple fore-coxæ of the male. There appears to be three species—a small one, a

medium-sized one with all tibiæ clear yellow, and a black one. I now describe the first two.

Ecacanthothrips coxalis, sp. n.

Length, ♂ 1.75, ♀ 2.1 mm.

This species (and the following one) has the fore-coxæ in the ♂ simple, and in the shape of the fore-femora and teeth comes nearest to *E. steinskyi* (Schmutz), but is only very minutely pilose. Colour dark reddish-brown, including the hind and intermediate tibiæ; fore-tibiæ greyish-yellow, with outer and inner margins brownish. Antennæ just about 2.0 the length of head, with joints 1 black, 2 to 4 entirely chestnut-brown, 5 to 8 lighter grey-brown with basal halves of 5 and 6 yellow, 4 broadly claviform, 5 much narrower and 3 to 5 subequal in length.

Head inclined to be broadly subcarinate dorsally, 1.65 times as long as broad; at least two stout genal spines on each side, postocular bristles not as long as the eyes, and a pair of knobbed subgenal setæ as in *bryanti* but much shorter.

Tube short, very stout; approximately 0.45 the length of the head.

Hab. W. SARAWAK, neighbourhood of Mt. Matang; 2 ♀s (1 to light), December 1913, and 1 ♂, February 1914 (*G. E. Bryant*).

Ecacanthothrips flavipes, sp. n.

♂.—Length about 2.6 mm.

Very dark brown, almost black, shining; all tibiæ and tarsi clear yellow. Antennal joints 4 and 5 yellow, shaded to brown basally and distally; joints 4 and 6–8 more slender than in *coxalis*; 4 and 5 subequal and each apparently longer than 3.

Head much as in *coxalis*, with the cheek-spines stouter; postocular bristles longer and the subgenal setæ distinctly shorter than in that species. Tube stout, about 0.6 the length of the head.

Easily separated from *coxalis* by its larger size, distinctive coloration of legs and antennæ, longer tube, and the stouter fifth and more slender fourth antennal joints. The setæ on fore-femora are not quite so minute, and the lower tooth is sharper and not so stout.

Hab. W. SARAWAK, Mt. Matang, at 1000 feet; one on a white flower and three on dead bark, December 1913 (*G. E. Bryant*).

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

March 10th, 1915.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The following communications were read :—

1. 'The Plants of the Late Glacial Deposits of the Lea Valley.' By Clement Reid, F.R.S., F.L.S., V.P.G.S.

Large collections of plants from the Lea Valley deposits, already described, have been made by Mr. S. H. Warren, Mr. E. T. Newton, and Mr. Wrigley. The localities from which the plants were obtained are Angel Road, Hedge Lane, Ponders End, and Temple Mills. A list from Ponders End has already been given by Dr. Lewis; but the new collections include many unrecorded species, several of which have not previously been noted as British fossils. Although there are slight differences, the collections from all four localities are so similar as to leave no doubt that the deposits are contemporaneous. The whole assemblage points to a very cold climate, though perhaps not quite so cold as that indicated by the Arctic plants found at Hoxne, in Suffolk.

Among the more interesting novelties may be mentioned *Armeria arctica*, a species of thrift now confined to Arctic America, although it has also been recorded as a Pleistocene fossil from the continent of Europe by Dr. C. A. Weber. Leaves of *Salix lapponum* are also abundant, though this species does not seem to have been found fossil elsewhere. Some delicately-veined membranes, probably identical with the 'petal-like objects' mentioned by Dr. Lewis, prove to be pods of the alpine *Draba incana*. Other shorter forms are pods of a scurvy-grass, not yet satisfactorily determined.

The extinct forms are a new species of *Silene*, near to *S. noctiflora* but quite distinct, and a new *Linum* with large seeds. This latter apparently is closely allied to our cultivated flax (*L. usitatissimum*), of which the origin is unknown. It may be an ancestor of our common flax, but this latter is unknown far north, and will not grow with Arctic plants; the seeds of the two are perceptibly different. No large-seeded flax is now living in the Arctic regions.

2. 'The Genus *Lonsdaleia* and *Dibunophyllum rugosum* (McCoy).' By Stanley Smith, B.A., M.Sc., F.G.S.

The present paper discusses the literature, structural characters and development, descent, classification, and distribution of the corals constituting the genus *Lonsdaleia*; it includes also a description of *Dibunophyllum rugosum* (McCoy). The Author's reasons for including a description of *D. rugosum* in the paper are, first, the fact that the species was originally described by McCoy as *Lonsdaleia rugosa*; and, secondly, that considerable confusion exists between it and the fasciculate forms of *Lonsdaleia*.

Lonsdaleia is a compound member of the Clisiophyllidæ, and

occurs both as fasciculate and as massive colonies. The chief distinguishing features of the genus are the wide extrathecal area, large dissepiments, complex central column, and horizontal and widely-spaced tabulæ. *Lonsdaleia* is an Avonian or Lower Carboniferous genus, especially abundant in the highest horizons of that series (D₂ and higher beds). The earliest example is *Lonsdaleia prænuntia*, from the *Syringothyris* Zone (C).

A number of species and local forms have been recognized and are described.

May 12th, 1915.—Dr. A. Smith Woodward, F.R.S., President, in the Chair.

The following communication was read:—

‘On *Parka decipiens* Fleming.’ By George Hickling, D.Sc., F.G.S., and Archibald W. R. Don, B.A., F.G.S.

The paper is a joint statement of originally independent investigations of this Old Red Sandstone organism. The views of Fleming, Hugh Miller, Mantell, Lyell, Powrie, Page, and others are quoted to illustrate the chequered career of this enigmatical fossil in geological literature. To Dawson and Penhallow, supported by Reid and MacNair, belongs the credit of making the first serious attempt to obtain definite evidence as to its nature, and of establishing its vegetable character. The present account is based on the observation of great numbers of specimens in the field, and on the microscopic study of impression-material, of thin sections, and of macerated material.

The plant is most abundant in the Lower Old Red of the Kincardine-Forfar-Perth area, where it is by far the commonest fossil, especially in the shale-bands; *Parka* is confined to the lower two-thirds of the Caledonian Series. It is recorded from a few other localities in Central Scotland, and also from the Upper Ludlow and Lower Old Red of the ‘Hereford’ area.

The organism is shown to be a complete cellular thalloid plant, agreeing generally in its vegetative structure with certain algæ, but differing from all known algæ in the production of cuticularized spores. The thallus is closely set with subcircular swellings (‘discs’), each enclosing a mass of simple spores (homosporous). An investing layer, probably one cell thick, of relatively large cells surrounds the smaller-celled ‘parenchyma’ of the thallus. The spore-masses are individually enclosed by the latter tissue, but there is no indication of a specialized sporangial wall. The growth of the plant is marginal and indefinite, and mature spores are found in plants of all sizes—that is, so far as observed, in all plants that are in a suitable state of preservation. The structure described by previous writers as an ‘indusium’ is interpreted as the ‘sole’ of the thallus in a more or less detached condition. While the general structure and mode of growth of the plant make it very difficult to place it higher than the Thallophyta, it must be recognized that the organism is in some respects unique.

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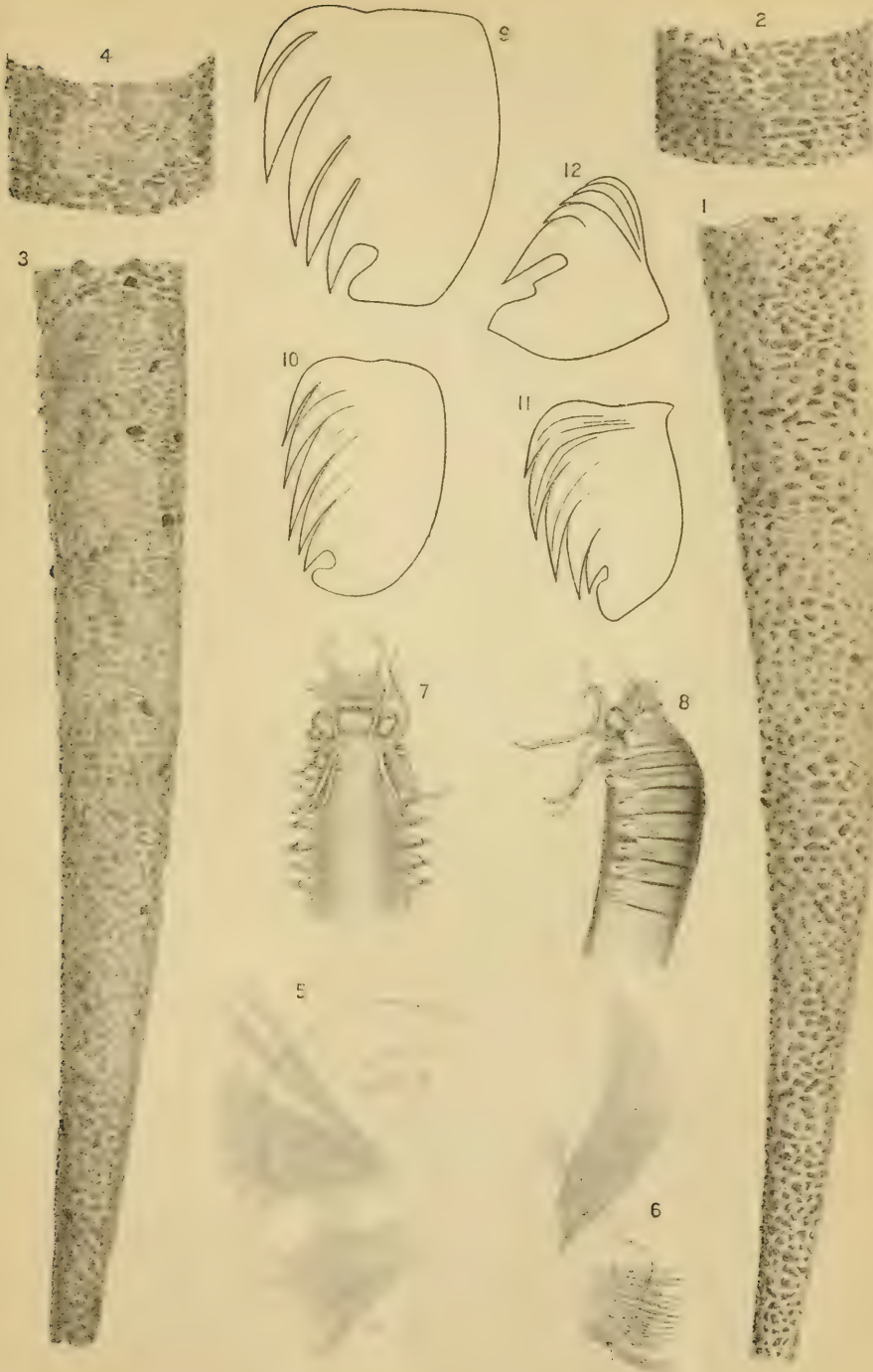
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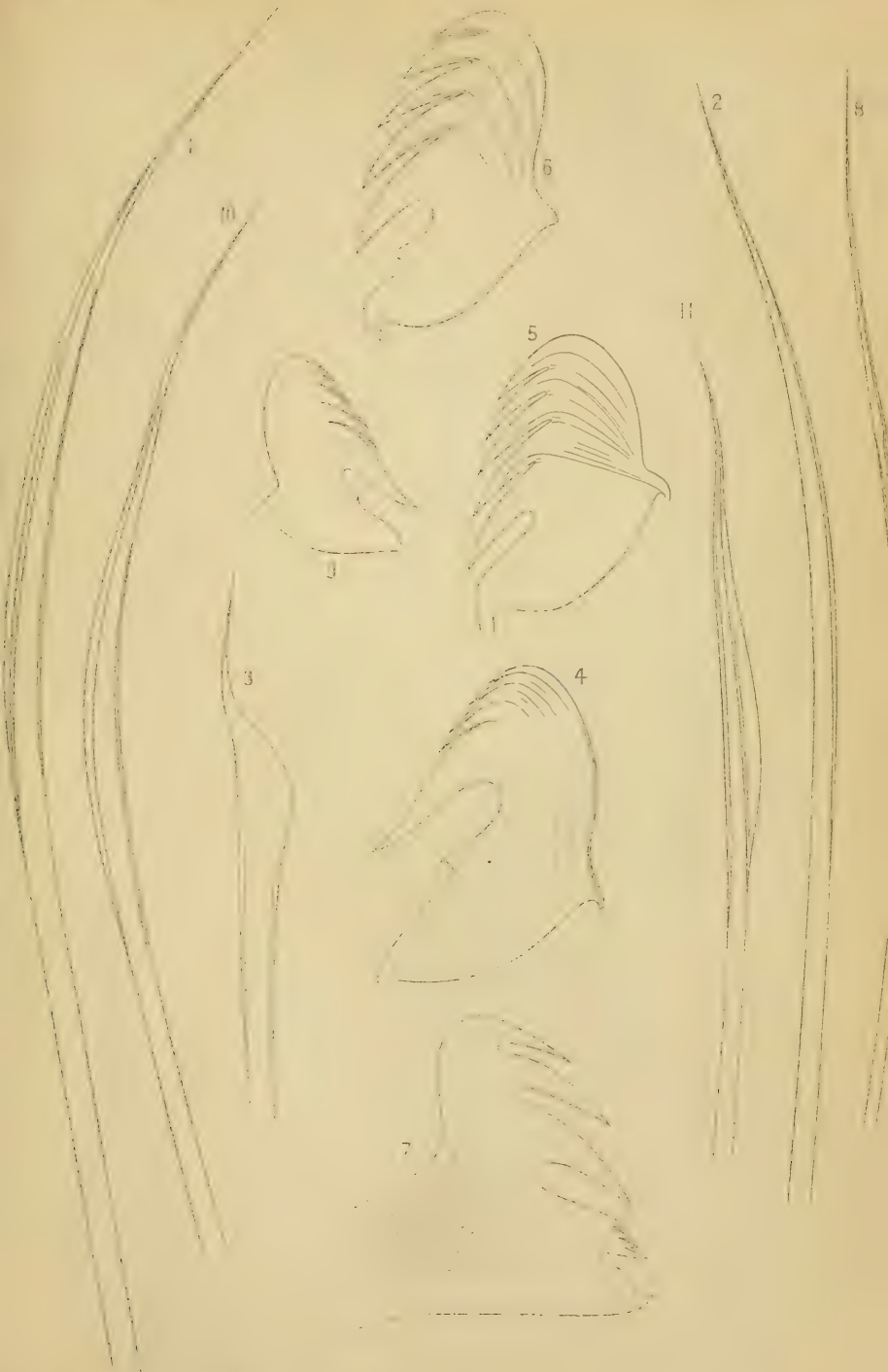
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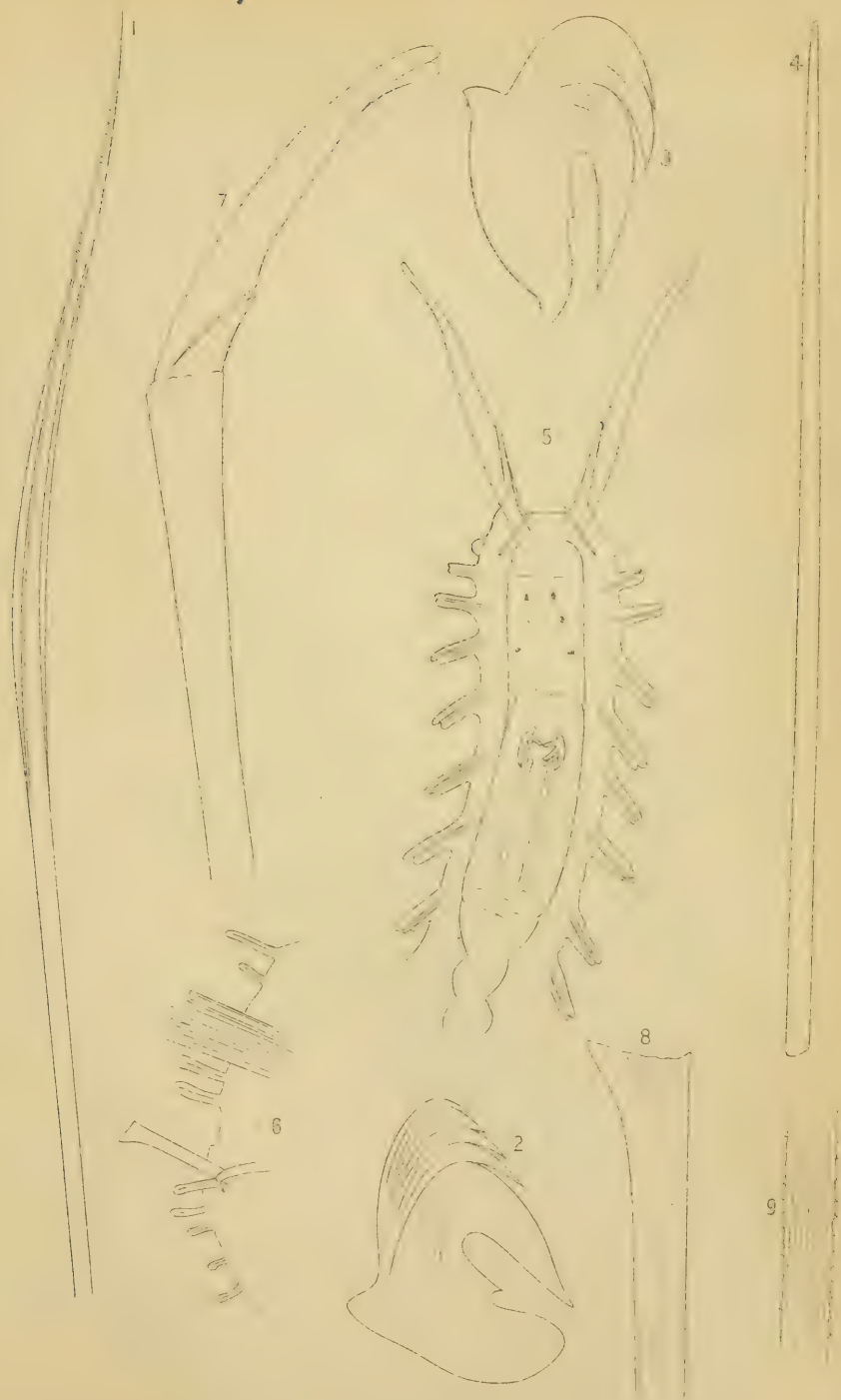
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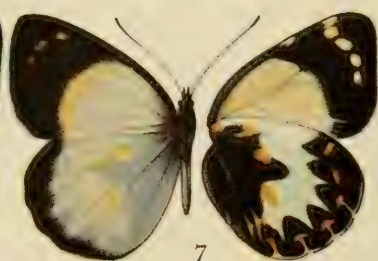


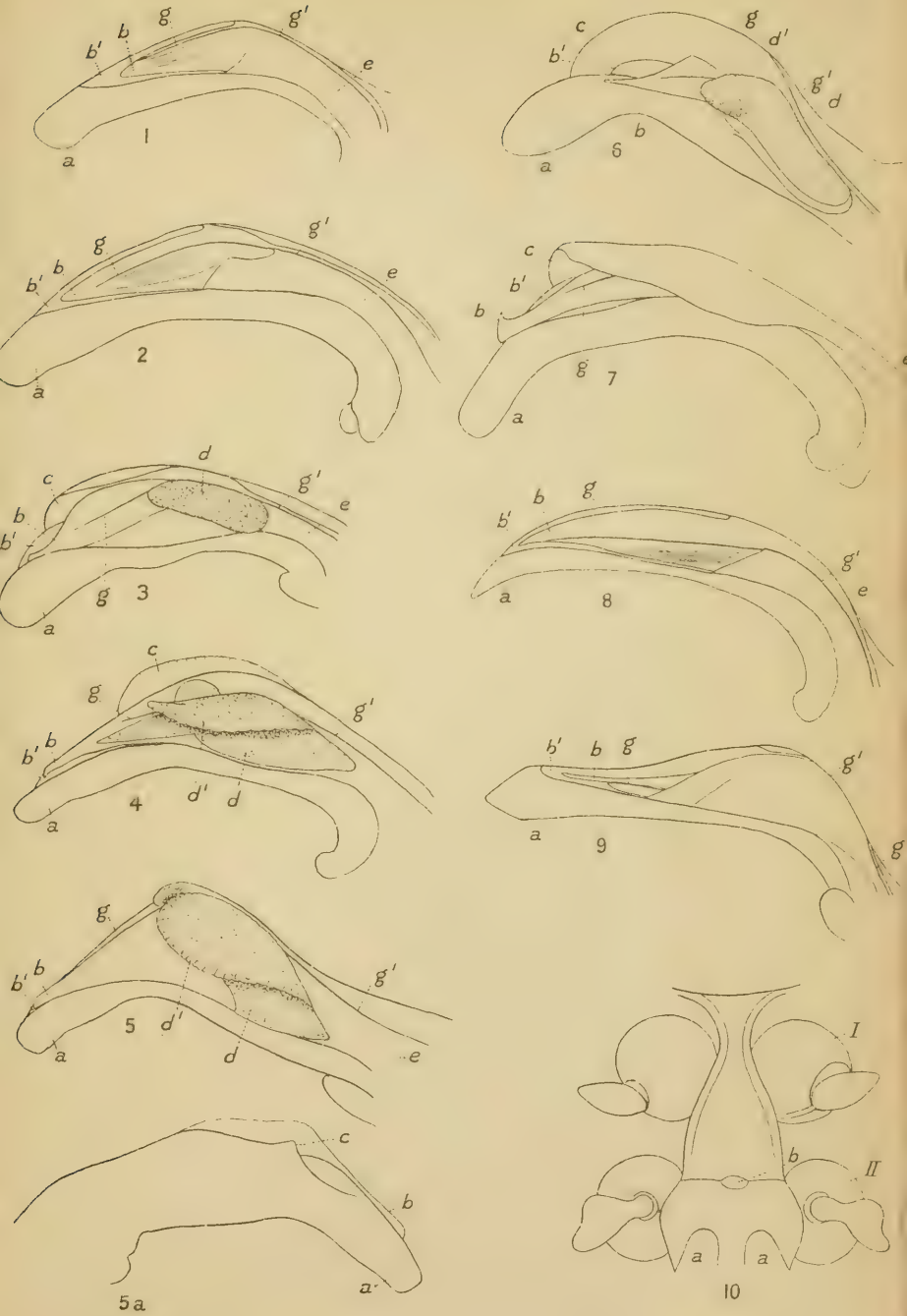
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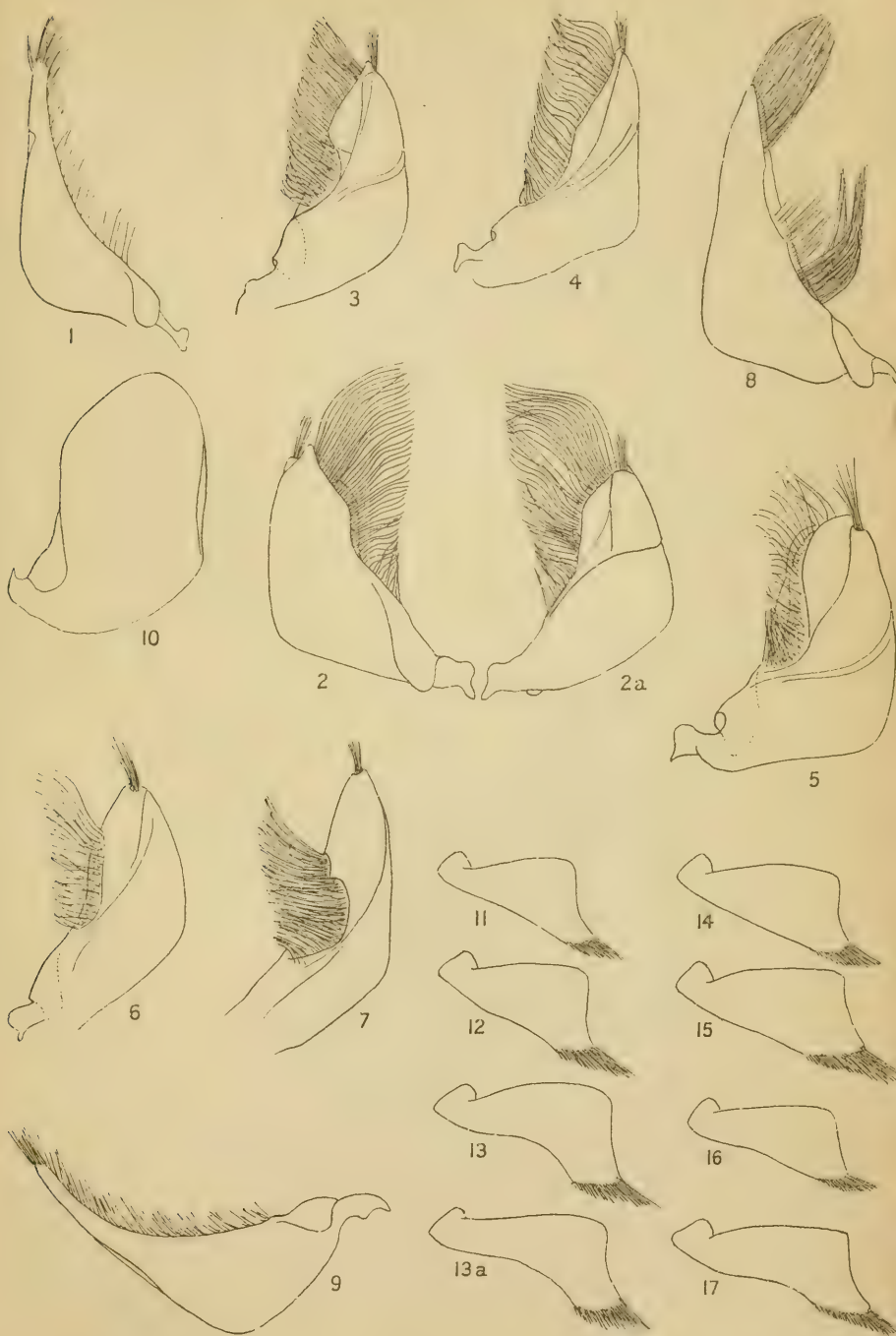


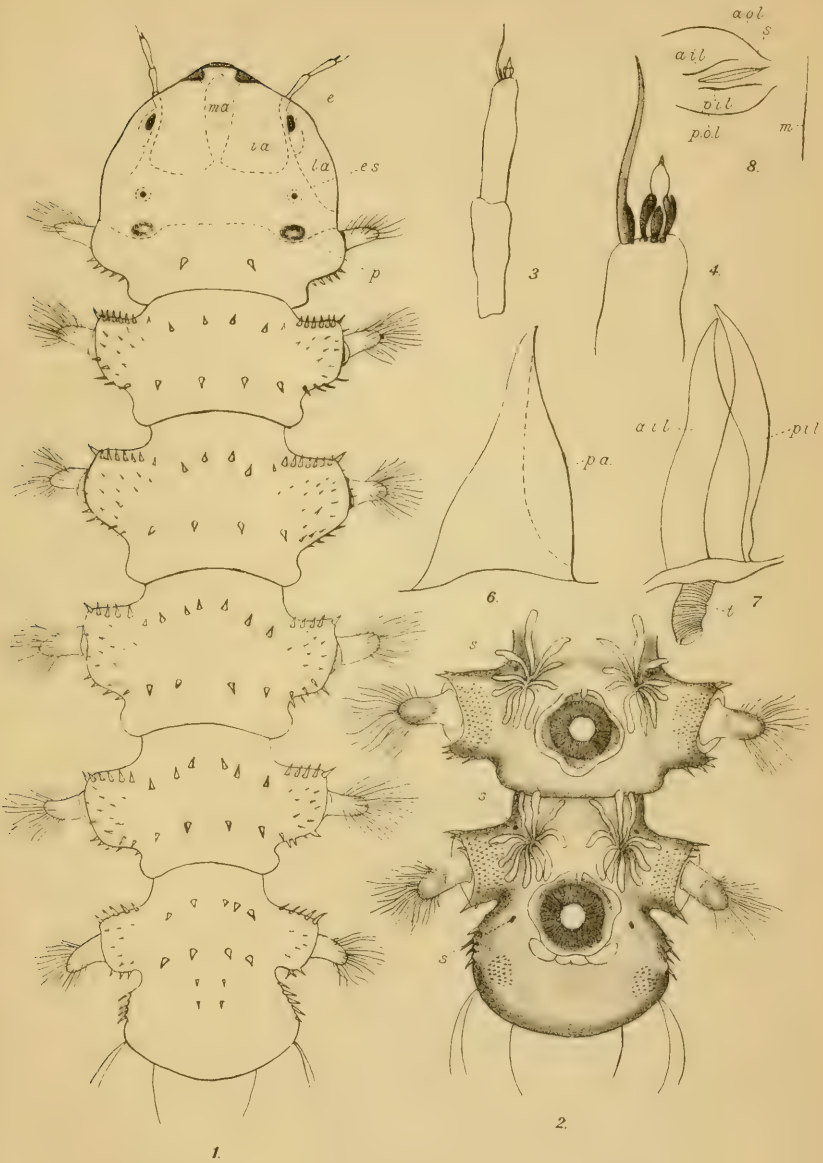


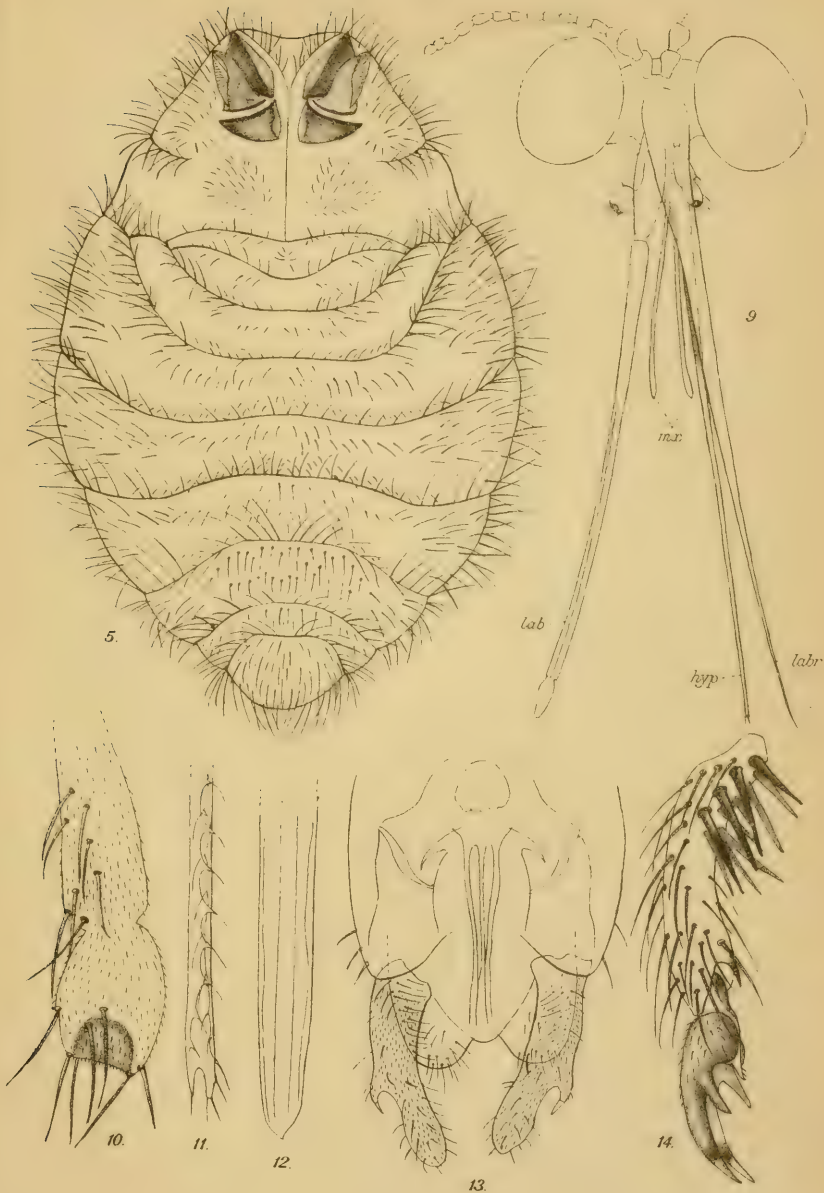
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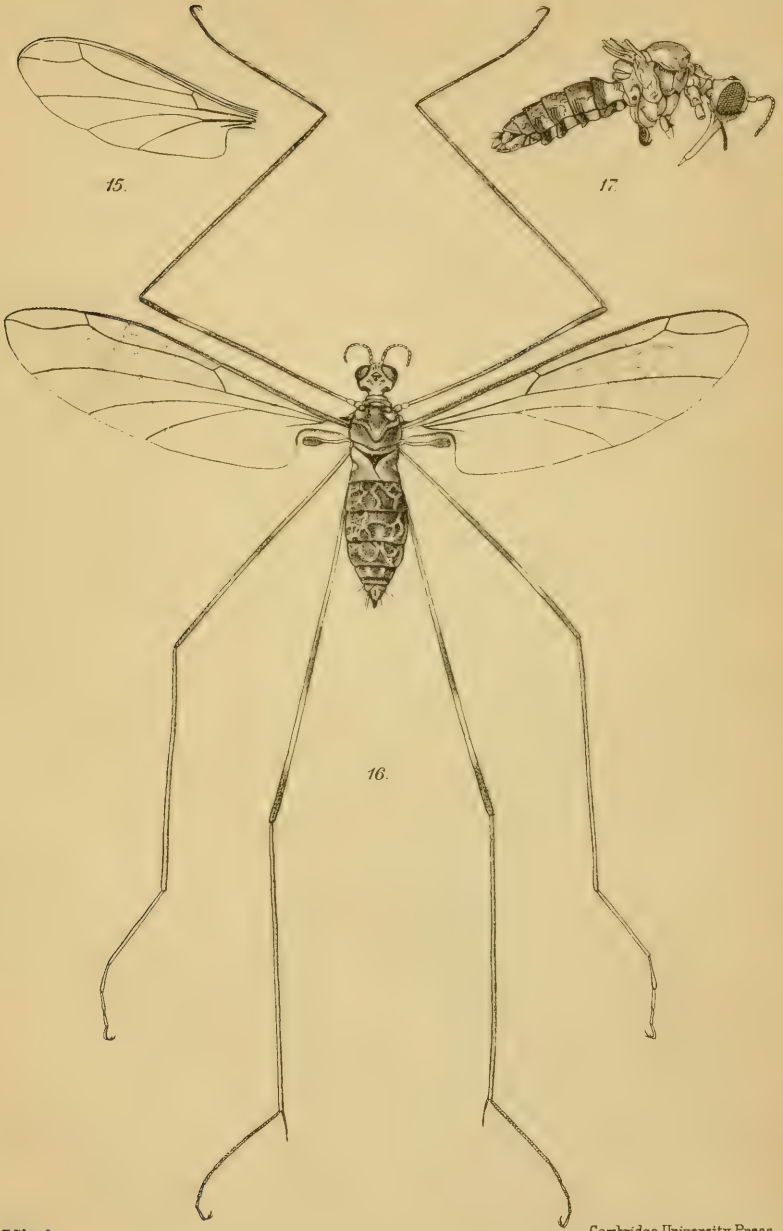




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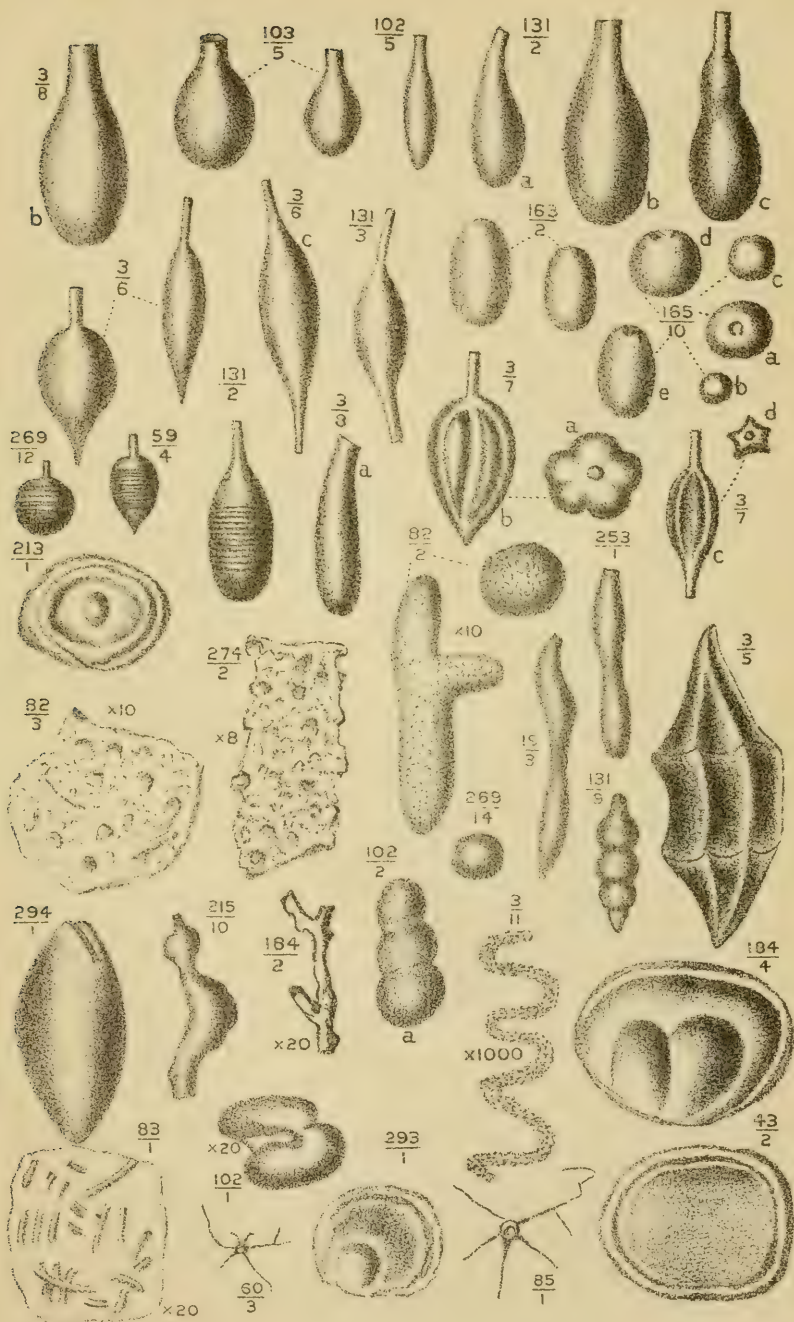


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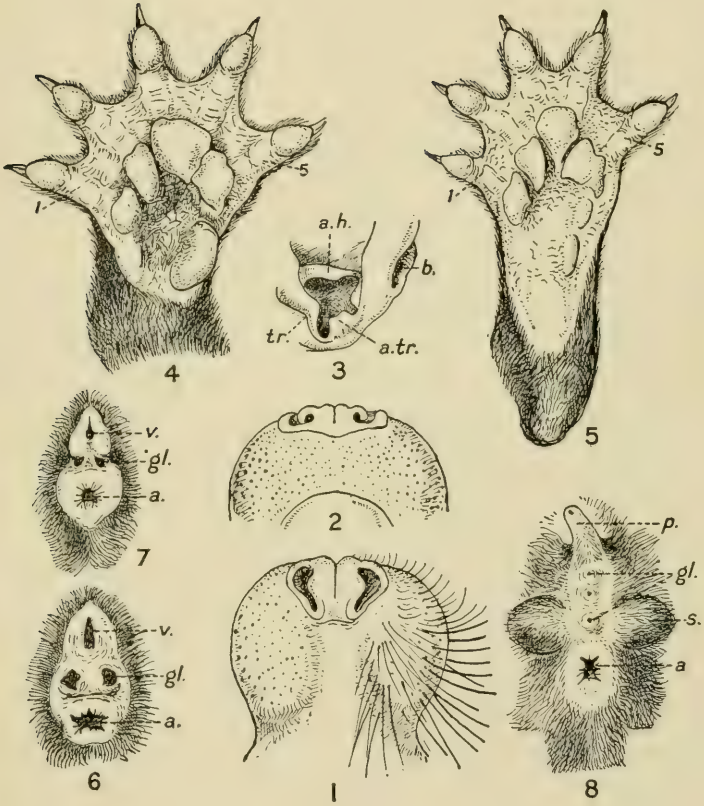
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